FLORIDA A&M UNIVERSITY

Board of Trustees
ACTION ITEM

Academic and Student Affairs Committee
Wednesday, June 1, 2022
Agenda Item: III

Subject: Minutes for February 17, 2022 Meeting

Proposed Board Action: In accordance with the Florida Statutes, a governmental body shall prepare and keep minutes or make a tape recording of each open meeting of the body.

Attachment(s): Yes

1. Minutes for February 17, 2022

FLORIDA A&M UNIVERSITY

Board of Trustees

Academic and Student Affairs Committee Minutes
Trustee Nicole Washington, Chair
February 17, 2022

The meeting was called to order by Trustee Nicole Washington. Ms. Valeria Singleton called the roll and the following committee members were present: Ann Marie Cavazos, Michael Dubose, Kristin Harper, David Lawrence, Nicole Washington, and Carrington Whigham. A quorum was established.

Trustee Harper moved to approve the minutes for the meeting on December 1, 2021. The motion was seconded by Trustee Cavazos and the motion carried.

The Committee recommended approval of the following items:

Academic Calendar (2023 - 2024) - The academic calendar for 2023 - 2024 was presented to the Board of Trustees for approval, in accordance with Florida Board of Education Rule 6A-10.019. The Board of Governors Regulation 8.001 requires each university to adopt an annual calendar which includes the beginning and ending dates for each semester, the dates for final examinations, and the dates for the issuance of diplomas.

The beginning and ending dates of each semester, the holidays, and the breaks have been agreed upon by the Calendar Committee which includes representatives from Florida A&M University, Florida State University, and Tallahassee Community College. The Calendar Committee meets annually to coordinate the calendars of the three educational institutions in Tallahassee. Listed below is the 2023 - 2024 academic calendar:

Semester	Beginning Date of Classes	Last Day of Classes	Finals
Fall 2023	8/28/2023	12/08/2023	December 11-15, 2023
Spring 2024	1/8/2024	4/28/2024	April 29 - May 3, 2024
Summer 2024 – Term 1 (C)	5/13/2024	8/1/2024	August 1-2, 2024
Summer 2024 – Term 2 (A)	5/13/2024	6/20/2024	June 20-21, 2024
Summer 2024 – Term 3 (B)	6/24/2024	8/1/2024	August 1-2, 2024

Trustee Cavazos moved to approve the academic calendar for 2023 - 2024. The motion was seconded by Trustee Harper and the motion carried.

Sabbatical and Professional Development Leave - Each year the University provides faculty with the opportunity to apply for sabbatical or professional development leave for the following year. This year,

four faculty members are being recommended for approval. In addition, there were no applications for professional development leave.

In reviewing the applications, the Sabbatical and Professional Leave Committee considered the programs and activities that will occur while on leave; the expected increase in value of the employee to the University and to the employee's academic discipline; specific results anticipated from the leave; and any other prior leaves that had been provided to the employee. The faculty members listed below were recommended for sabbatical leave:

1. Terrell Brown, CSSAH (Spring 2023)
2. Natalie King-Pedroso, CSSAH (Fall 2022)
3. Jenelle Robinson, CAFS (Fall 2022)
4. Rebecca Sager, CSSAH (Fall 2022 and Spring 2023)

Trustee Cavazos moved to approve the sabbatical leave. The motion was seconded by Trustee Harper and the motion carried.

Request for Leave Without Pay for Rhoda Cato - In accordance with BOT Policy Number 2005-21, the University will consider requests for unpaid leave of absence from regular employees who have at least one year of continuous service. The University grants leave of absence for the following reasons: parental, medical, educational, military service, and personal. Professor Cato has requested leave without pay for January 10 through May 6, 2022.

Trustee Harper moved to approve the request for leave without pay for Rhoda Cato from January 10 through May 6, 2022. The motion was seconded by Trustee Cavazos and the motion carried.

Student Affairs Updates – informational updates were provided:

- Dr. William Hudson, Jr., and his team provided updates on enrollment, campus safety, emergency management, and an update on hazing prevention.
- A snapshot of fall 2022 admissions for first time in college (FTIC) and Florida College System (FCS) applicants was provided.
  - Admissions applications are up by 28% compared to last year and 36% compared to 2020.
  - There is a 33% increase in FTIC applications and 32% in admitted students.
- Chief Terence Calloway provided an update on campus security.
  - The Florida A&M University Department of Campus Safety & Security (FAMU DCSS) is dedicated to helping provide a safe, protected, and secure environment for students, faculty, staff, alumni, and visitors to our campus. FAMU DCSS, also known as the University Police Department or FAMU PD, provides services 24 hours a day, 7 days a week, and 365 days a year.
  - The department is the only HBCU to be triple-accredited and offers a range of police resources, security event planning, and parking management. This means FAMU PD is accredited by the state of Florida, national accreditation by the Commission of

Accreditation for Law Enforcement Agencies, and internationally by the International Association of Campus Law Enforcement Administrators.

- DCSS uses several crime prevention programs and services to help maintain a safe and healthy campus. The programs and services include Operation ID and Operation Book stamp (property identification methods in which items are engraved or stamped for owner identification); FAMU orientation sessions with crime prevention tips and resources; and guest speakers at University activities to provide information regarding parking services, self-defense courses, identity theft, and wellness checks.
- In collaboration with the Student Government Association (SGA), the Office of Transportation will launch a pilot program called F.A.N.G.S. (FAMU's at Night Get Around Shuttle) which will run Thursday through Sunday from 10 pm until 1 am. The shuttle will provide transportation only on-campus. DCSS is also partnering with the SGA on the Student Escort Team which will provide trained student escorts to assist with increasing student awareness of the University's available preventative and crime response programs.
- During the recent bomb threats on HBCU campuses, FAMU has been proactive in meeting with local authorities and has developed a strategy for potential threats to FAMU. A Bomb Threat Procedures Checklist was distributed campus-wide and Memorandums of Understanding were enacted with the Leon County Bomb Response Team.

- Mr. Ashley Davis provided an update on emergency management.
  - As the Emergency Management Director, his role is to assist in coordinating a comprehensive emergency management program to prevent, prepare for, respond to, and recover from disasters that could disrupt the University's educational operations.
  - Objectives that have been completed to date:
    - Emergency Operations Center (EOC): During the homecoming festivities, the EOC was activated in the CASS Building (3rd Floor Conference Room) to test the University's capabilities and connectivity to campus, local, and state partners.
    - Emergency Management Partners: Support SUS Emergency Management by participating in monthly meetings. In November 2021, the SUS met with the Florida Division of Emergency Management (FDEM) and the Board of Governors (BOG) to discuss areas to integrate into the State EOC to gather intel pre and post disasters via the BOG.
    - HBCU Emergency Management Consortium: Mr. Davis has been appointed to serve on the consortium. The consortium collects resources that focus on HBCUs and emergency management training.
    - Training on Emergency Management: Training ("FAMU Fundamentals 2022") has been implemented for faculty, staff, and select student employees.
  - Objectives that are ongoing or in the future include: Federal Emergency Management (FEMA) public assistance for COVID-19 operations, "establish a system of communications and warning to ensure that the state's population and emergency management agencies are warned of developing emergency situations and can communicate emergency response

decisions," shelter operations, emergency management plans, and emergency preparation exercise.

- The final informational update was from Mr. Bryan Smith regarding the hazing prevention initiatives.
  - The 2022 Hazing Prevention Summit will be in conjunction with the SUS Campus Safety Retreat in July on the campus of University of South Florida.
  - Since the inception of the Alivetek online course, there have been 8,479 students to complete the Hazing Prevention course.
  - There are two pending investigations.

Academic Affairs Updates – The following informational updates were provided:

- Provost Edington provided brief updates.
  - For spring 2022, 90.75% of the courses are being taught in-person, 9.25% of the courses are being taught online.
  - Discussed Faculty Excellence Initiatives: The Teaching and Learning Center and the new Emerging Leaders Initiative professional development training opportunity for faculty with leadership aspirations. Components of the program consist of a series of training sessions such fiscal management, leadership skills, and shadowing. The program does not prepare the participants for a specific role, but enhance their talents and skills so that they can pursue future opportunities and/or higher roles.
  - Discussed the Academic Program Prioritization Initiative to include a recap of the project rationale, next steps, BOT feedback, programs' scores against programs' corresponding rankings, program pathways, timeline of activities by pathway, and syndication of the materials.
  - HelioCampus Project – The team has been working with HelioCampus to help equip FAMU with dashboards that are focused on academic performance management to include academic portfolio analysis, teaching workload, and low enrollment courses.
  - Update on Key Searches – There are currently three open searches: Dean, FAMU-FSU College of Engineering; Associate Provost/Dean, School of Graduate Studies and Research; and Director, Meek-Eaton Black Archives.
  - There was an in-depth discussion regarding the faculty hiring process to include tenure upon appointment process. Provost Edington provided context on the criteria for tenure upon appointment and how it is utilized within the university as a recruitment tool for key strategic positions. Provost Edington provided that he would follow-up with a university-wide tenure upon appointment process and justification for board members to see the factors that the committee based their decision upon at a future committee meeting.

There being no further discussion, the meeting was adjourned at 10:40 a.m.

Respectfully submitted,

Nicole Washington, Committee Chair

FLORIDA A&M UNIVERSITY

Board of Trustees
ACTION ITEM

Academic and Student Affairs Committee
Wednesday, June 1, 2022
Agenda Item: IV

Subject: Tenure

Proposed Board Action: Applications for tenure were reviewed by the departments, the colleges/schools, the University Tenure and Promotion Committee, Provost Edington, and President Robinson. The applicants were evaluated based on their professional experiences, teaching effectiveness, university service, public service, demonstrated contributions to their teaching discipline, technical and performance competencies, records of publications and research, certifications and exceptional scholarly or creative activities.

Attachments: No

	Candidate Name	College/School	Department/Division	Levels of Internal Review
1	Askal Ali	College of Pharmacy and Pharmaceutical Sciences_ Institute of Public Health (COPPS_IPH)	Institute of Public Health	- COPPS_IPH Committee - COPPS_IPH Dean - University-wide Tenure and Promotion Committee - Provost
2	Ezzeldin Aly	College of Education (COEdu)	Department of Health, Physical Education and Recreation	- HPER Department Chair - HPER Department - COEdu Dean - University-wide Tenure and Promotion Committee - Provost

FLORIDA A&M UNIVERSITY

Board of Trustees

ACTION ITEM

	Candidate Name	College/School	Department/Division	Levels of Internal Review
3	Jamal Brown	College of Pharmacy and Pharmaceutical Sciences_ Institute of Public Health (COPPS_IPH)	Pharmacy Practice	- COPPS_IPH Committee - COPPS_IPH Dean - University-wide Tenure and Promotion Committee - Provost
4	Beni Dangi	College of Science and Technology (CST)	Department of Chemistry	- Chemistry Department Chair - Chemistry Department - CST Dean - University-wide Tenure and Promotion Committee - Provost
5	Maxim Dulebenets	College of Engineering (COEng)	Department of Civil and Environmental Engineering	- Civil/ Environmental Engineering Department Chair - Civil/ Environmental Engineering Department - COEng Dean - University-wide Tenure and Promotion Committee - Provost
6	Islam Elsharkawy	College of Agriculture and Food Sciences (CAFS)	N/A	- CAFS Committee - CAFS Dean - University-wide Tenure and Promotion Committee - Provost

FLORIDA A&M UNIVERSITY

Board of Trustees

ACTION ITEM

	Candidate Name	College/School	Department/Division	Levels of Internal Review
7	Quovadis Epps	College of Pharmacy and Pharmaceutical Sciences_ Institute of Public Health (COPPS_IPH)	Pharmacy Practice	- COPPS_IPH Committee - COPPS_IPH Dean - University-wide Tenure and Promotion Committee - Provost
8	Lisa Gardner	School of Nursing (SON)	N/A	- SON Committee - SON Dean - University-wide Tenure and Promotion Committee - Provost
9	Sherif Gendy	School of Allied Health Sciences (SOAHS)	Division of Physical Therapy	- SOAHS Committee - SOAHS Dean - University-wide Tenure and Promotion Committee - Provost
10	Kurt Gray	School of Allied Health Sciences (SOAHS)	Division of Physical Therapy	- SOAHS Committee - SOAHS Dean - University-wide Tenure and Promotion Committee - Provost
11	Muhammad Haseeb	College of Agriculture and Food Sciences (CAFS)	N/A	- CAFS Committee - CAFS Dean - University-wide Tenure and Promotion Committee - Provost

FLORIDA A&M UNIVERSITY

Board of Trustees

ACTION ITEM

	Candidate Name	College/School	Department/Division	Levels of Internal Review
12	Michael Martinez Colon	School of the Environment (SOE)	N/A	- SOE Committee - SOE Dean - University-wide Tenure and Promotion Committee - Provost
13	Carswella Phillips	School of Nursing (SON)	N/A	- SON Committee - SON Dean - University-wide Tenure and Promotion Committee - Provost
14	Behnam Shadravan	School of Architecture and Engineering Technology (SAET)	Division of Engineering Technology	- Engineering Technology Division Director - Engineering Technology Division Committee - SAET Dean - University-wide Tenure and Promotion Committee - Provost
15	Komalavalli Thirunavukkuarasu	College of Science and Technology	Department of Physics	- Physics Department Chair - Physics Department - CST Dean - University-wide Tenure and Promotion Committee - Provost

FLORIDA A&M UNIVERSITY

Board of Trustees
ACTION ITEM

Academic and Student Affairs Committee
Wednesday, June 1, 2022
Agenda Item: V

Subject: Master of Science and Ph.D. Materials Science and Engineering (40.1001)

Rationale: Florida A&M University proposes an interdisciplinary master's and doctoral program in Materials Science and Engineering (MS&E) beginning Fall 2022. The proposed programs will be offered jointly within the FAMU-FSU College of Engineering and utilize faculty that currently teach within the existing MS&E program at Florida State University (FSU), related programs within the College, and Physics and Chemistry departments on the Main campus of FAMU. The joint FAMU-FSU MS&E program will be symmetric on the FSU and FAMU sides, creating opportunities for increased collaboration between faculty on the Main campus, specifically in Chemistry and Physics. More importantly, FAMU students will be able to enroll in the joint MS&E program. Admissions to the program and curriculum are designed to build upon undergraduate experiences from a wide range of degrees, such as engineering, architecture, and engineering technology.

Since the program is already approved by FSU and resides within the joint College, the FAMU program will utilize the same curriculum to ensure continuity of learning outcomes. The current curriculum has three required core foundation courses related to materials science and electives to expand students' experiences in different areas. Students may also take advantage of cutting-edge doctoral research in the existing program in magnetic and superconducting materials, which is unique in the United States due to the physical location of the National High Magnetic Field Laboratory at FSU.

Proposed Board Action: It is recommended that the FAMU Board of Trustees approve a Master of Science and doctoral degrees in Materials Science and Engineering effective Fall 2023.

Attachments: FAMU Materials Science and Engineering Proposal

FLORIDA A&M UNIVERSITY

Materials Science and Engineering Programs Overview

Florida A&M University proposes an interdisciplinary master's and doctoral program in Materials Science and Engineering (MS&E) beginning Spring 2023. The proposed programs will be offered jointly within the FAMU-FSU College of Engineering and utilize faculty that currently teach at the joint College, the existing MS&E program at Florida State University (FSU), and related programs within the College, and Physics and Chemistry departments on the Main campus of FAMU. The MS&E programs were created at FSU initially and was administered by the Graduate School until Spring 2021, when it was moved to the FAMU-FSU College of Engineering (COE). With MS&E in FAMU-FSU COE, the time is right to create FAMU MS&E and establish joint FAMU-FSU MS&E programs. The joint FAMU-FSU MS&E programs will be symmetric on the FSU and FAMU sides, creating opportunities for increased collaboration between faculty on the Main campus, specifically in Chemistry and Physics. More importantly, FAMU students will be able to enroll in the joint MS&E programs. Admissions to the programs and curricula are designed to build upon undergraduate experiences from a wide range of degrees, such as engineering, architecture, and engineering technology.

Since the programs are already approved by FSU and resides within the joint College, the FAMU programs will utilize the same curriculum to ensure continuity of learning outcomes. The current curriculum has three required core foundation courses related to materials science and electives to expand students' experiences in different areas. Students may also take advantage of cutting-edge doctoral research in the existing program in magnetic and superconducting materials, which is unique in the United States due to the physical location of the National High Magnetic Field Laboratory at FSU.

Materials Science as a Discipline

The field of materials science underlies the discovery and development of new materials and improvements in existing materials that are critical to developing new technologies. Society and prospective students know about materials because materials have defined humankind's advances through the ages of stone, bronze, and iron. We are possibly living in what future generations will call the silicon age. Materials science is critical for creating and improving microprocessors for faster, more compact electronic devices, including computers and cell phones. Producing green energy and energy storage depends on advances in materials. The aerospace industry needs lighter and stronger materials, including all-electric airplanes that use electric motors rather than jet engines. This requires new and improved materials. Doctoral-level students will not only be trained on the skills needed within the industry, but they will also become leaders within the industry to help advance the organization's goals and objectives. Additionally, doctoral-level prepared students will be eligible to seek positions in academia. The FAMU MS&E program will expand diversity within a discipline where minorities are traditionally underrepresented.

Creating the FAMU MS&E program will be relatively inexpensive because it will be built around existing FAMU faculty members and will use the courses already developed and offered within the FSU MS&E program. Further, it will allow faculty members in the FAMU Chemistry and

Physics departments to advise Ph.D. students. Because the program currently shares faculty within the FAMU-FSU College of Engineering, sufficient resources are available to offer the program to students who enroll at FAMU.

Need and Demand

High technology industries have an increasing demand for materials scientists, including manufacturing, automotive, aerospace, catalysis, electronics, construction, medical science, and nanotechnology. The Bureau of Labor Statistics anticipates steady growth for materials engineers over the next ten years. Growth is expected to be particularly strong for materials scientists and engineers working on nanomaterials and biomaterials. Also, according to the Aerospace Industries Association, there will be a need for more people in the aerospace industries, including materials scientists, as baby boomers retire, and the industry creates more advanced designs with more outstanding capabilities and higher efficiencies.

Florida has a solid national presence in key economic sectors such as aerospace, defense, marine, and space. Lockheed Martin, Boeing, Raytheon, Northrop Grumman, and General Dynamics – top aerospace/defense companies in the U.S. – all have substantial operations in Florida and all employ materials scientists. New materials are essential to advances in these industries, such as the carbon-fiber composites used in military aircraft and the latest commercial Boeing and AirBus planes. On the national level, well-known companies in which materials scientists and engineers play vital roles include 3M, Apple, Alcoa, Boeing, Cummins, DuPont, Exxon Mobil, General Dynamics, GE, General Motors, HP, IBM, Intel, Lockheed Martin, Motorola, and Xerox. The MS&E graduates can also work in research and development in academia, national labs, and industrial labs. The median annual wage for materials engineers ranges upwards of the mid $90K nationally and in the state of Florida.

Program Description and Relationship to System-Level Goals

MS&E contributes directly to several of the SUS Strategic Planning Goals in the 2025 System Strategic Plan[a]. The specific areas are:

Teaching and Learning

- Strengthen Quality and Reputation of the Universities
- Increase Degree Productivity & Program Efficiency. The proposed degree will increase degree productivity within the FAMU-FSU College of Engineering as a joint College and doctoral degree production at FAMU.
- Increase the Number of Degrees Awarded in Programs of Strategic Emphasis. The program Ph.D. falls under the category of STEM.

Scholarship, Research and Innovation

- Strengthen the Quality and Reputation of Scholarship, Research, and Innovation

[a] https://www.flbog.edu/wp-content/uploads/2025_System_Strategic_Plan_2019.pdf

- Increase Research Activity and Attract More External Funding

It is also consistent with several Goals in FAMU's Strategic Plan[b], specifically goals in:

Strategic Priority 3: High Impact Research, Commercialization, Outreach, And Extension Services

- *Goal 1*: Expand and enhance cutting-edge research and creative scholarship for the benefit of the state of Florida, the nation, and the world
- *Goal 2*: Increase research productivity, commercialization and return on investment
- *Goal 3*: Increase the number of nationally recognized graduate programs

FAMU and FSU have faculty in STEM fields who will collaborate in the interdisciplinary MS&E program. At FAMU, faculty from engineering, physics, and chemistry will participate at the onset. As the program grows, additional faculty will be added to the program. Current faculty from both institutions have been successful writing proposals and receiving external funding to do cutting edge research. As the MS&E Ph.D. and master's programs will help attract additional graduate students, greater contributions to the SUS Strategic Planning Goals and FAMU Strategic Plan are anticipated as the program grows. This program supports the FAMU and SUS missions of educating more diverse students in high-tech STEM fields to compete in the 21st century global economy. Similar programs are offered within the State University System at Florida International University, Florida State University, University of Central Florida, and University of Florida.

Projected Benefit of the Program to the University, Local Community, and State

Numerous reasons exist to offer a joint program between FAMU and Florida State University, particularly as the program already exists within the FAMU-FSU College of Engineering. If implemented, the program will have multiple benefits to FAMU, FSU, the Panhandle region, the State of Florida, and the Nation that includes the following:

- Provide a means to recruit students interested in studying MS&E and create a way to educate and train them to earn a Ph.D. in a broad, interdisciplinary manner.
- Build on the sizable investments FAMU and FSU have made in start-up packages and infrastructure support for faculty members researching materials-related areas.
- Relatively inexpensive to implement this new Ph.D. program.
- Increase FAMU-FSU College of Engineering research visibility.
- Provide increased opportunities for FAMU and FSU to secure greater funding in materials research, particularly large-scale, interdisciplinary grants. Over the past decade, federal research awards to interdisciplinary teams in materials areas have increased substantially.
- Address the critical education need to produce more engineers within the United States and Florida, especially in the areas of materials.

[b] https://www.famu.edu/Strategic/FAMU%20Strategic%20Plan%202017-2022%20Final_reduced%20size.pdf

- Contribute to research, economic development, and job creation in the Panhandle region and across the State.
- Increase the Nation's technical capability by attracting and enabling additional research and highly trained researchers for new product development.
- Help address underrepresentation of minorities in STEM disciplines, engineering in particular. The FAMU-FSU College of Engineering has already demonstrated progress in this area by being the number four producer of PhDs to African Americans of all US engineering schools.

Projected Enrollment
Estimated enrollment for the MS&E programs is modest in the first five years with initial enrollment of two-three students in each program. These projections are based on past trends of enrollment of the program at Florida State University. However, as both programs will now reside in the FAMU-FSU College of Engineering, enrollment growth is expected to increase significantly with greater visibility.

Faculty Participation
The MS&E programs will be complemented by existing faculty at the joint FAMU-FSU College of Engineering, FAMU chemistry faculty, and FAMU physics faculty. Faculty already teaching in the FSU Materials Engineering degree will also continue to teach courses required for the degree as part of the joint College.

Admissions
MS&E will follow FAMU's admission standards with the following additional requirements. Additional requirements above the minimum may also be imposed.

Graduation Criteria
All students must pass all of the required coursework (minimum of 24 credit hours of graded course work) with a minimum 3.0 GPA. In addition to meeting the university requirement to maintain an overall GPA of 3.0 or above, MS&E students need to achieve a grade of "B" or better in each core course. Additional requirements specific the level will be provided upon acceptance and enrollment.

Curriculum
The curriculum will be identical for FAMU and FSU students, and in the first year, the curriculum will use courses within the existing curriculum.

STATE UNIVERSITY SYSTEM OF FLORIDA

Board of Governors, State University System of Florida

REQUEST TO OFFER A NEW DEGREE PROGRAM

In Accordance with BOG Regulation 8.011

(Please do not revise this proposal format without prior approval from Board staff)

Florida A&M University **Institution Submitting Proposal**	**Spring 2023** **Proposed Implementation Term**
FAMU-FSU College of Engineering **Name of College(s) or School(s)**	**Name of Department(s)/Division(s)**
Materials Science and Engineering **Academic Specialty or Field**	**Master of Science in Materials Science and Engineering** **Complete Name of Degree**
40.1001 (or 14.1801) **Proposed CIP Code (2020 CIP)**	

The submission of this proposal constitutes a commitment by the university that, if the proposal is approved, the necessary financial resources and the criteria for establishing new programs have been met prior to the initiation of the program.

Date Approved by the University Board of Trustees	**President's Signature** **Date**
Board of Trustees Chair's Signature **Date**	**Provost's Signature** **Date**

PROJECTED ENROLLMENTS AND PROGRAM COSTS

Provide headcount (HC) and full-time equivalent (FTE) student estimates for Years 1 through 5. HC and FTE estimates should be identical to those in Appendix A – Table 1. Indicate the program costs for the first and the fifth years of implementation as shown in the appropriate columns in Appendix A – Table 3A or 3B. Calculate an Educational and General (E&G) cost per FTE for Years 1 and 5 by dividing total E&G by FTE.

Implementation Timeframe	HC	FTE	E&G Cost per FTE	E&G Funds	Contract & Grants Funds	Auxiliary/ Philanthropy Funds	Total Cost
Year 1	3	3	$13,549	$40,647	$54,585		$95,232
Year 2	5	5					
Year 3	6	6					
Year 4	8	8					
Year 5	10	10	$4,065	$40,647	$159,585		$200,232

Additional Required Signatures

I confirm that I have reviewed and approved Need and Demand Section III.F. of this proposal.

Signature of Equal Opportunity Officer	**Date**

I confirm that I have reviewed and approved Non-Faculty Resources Section VIII.A. and VIII.B. of this proposal.

Signature of Library Dean/Director	**Date**

Introduction

I. Program Description and Relationship to System-Level Goals

A. Describe within a few paragraphs the proposed program under consideration, and its overall purpose, including:

- **degree level(s)**
- **majors, concentrations, tracks, specializations, or areas of emphasis**
- **total number of credit hours**
- **possible career outcomes for each major (provide additional details on meeting workforce need in Section III)**

Florida A&M University proposes to offer an interdisciplinary master's degree program in Materials Science and Engineering (MS&E) beginning Spring 2023. The proposed program will be offered jointly within the FAMU-FSU College of Engineering and utilize faculty that currently teach within the existing MS&E program at Florida State University (FSU), related programs in the College, and Physics and Chemistry departments on the Main campus of FAMU.

Students entering the M.S. thesis program with a Bachelor of Science (B.S.) degree are required to a take a minimum of 30 credits including at least 24 credits of letter-graded courses and at least 6 credits of thesis research. Students will also take an Interdisciplinary Seminar Series each semester. In the seminar series, students will be exposed to FAMU and FSU faculty and external researchers working in the area of MS&E. They will learn presentation skills and present their research. The seminar series is the glue that binds the MS&E students as a community, as they conduct their research in labs on the main FAMU campus, in the FAMU-FSU College of Engineering, or in Innovation Park. Students entering the M.S.-non-thesis program with a B.S. degree are required to a take a minimum of 30 credits including at least 27 credits of letter-graded courses and may take 3 credits of non-letter-graded courses. These students will also take the seminar series throughout their matriculation.

As background information, Materials Science is defined by the National Center for Education Statistics (NCES) under CIP Code 40.1001 as " A program that focuses on the general application of mathematical and scientific principles to the analysis and evaluation of the characteristics and behavior of solids, including internal structure, chemical properties, transport, and energy flow properties, thermodynamics of solids, stress and failure factors, chemical transformation states and processes, compound materials, and research on industrial applications of specific materials." Historically, periods have been referenced to materials, such as the Stone Age, the Bronze Age, the Iron Age, and most recently, the Silicon Age. A similar CIP code (14.1801) exists in a related discipline, materials engineering and is utilized at other SUS institutions. In today's society, familiarity with materials is based on current technologies that depend on advanced materials that improve people's lives like batteries that power electronic devices and electric vehicles; solar cells for green energy; integrated circuits, solid-state memory, and displays for electronic devices; lightweight, smart prostheses; and advanced composites (more than 50% by weight) in the latest generation of commercial aircraft. The MS&E program at FAMU and FSU will allow students to gain specialty in areas of magnetic materials, materials for 3-D printing, nano biomaterials, multifunctional polymers, sensors for structural materials, catalysts, and electrolytes for batteries.

Materials Science and Engineering programs were created at FSU in 2008 and were administered by the FSU Graduate School until Spring 2021, when they were moved to the FAMU-FSU College of Engineering (COE). The Materials Science and Engineering degree (master's and doctoral) programs now residing in the FAMU-FSU COE create an opportunity for FAMU students to participate by creating a joint program between the Universities, similar to all other programs within the College. Additionally, the programs create opportunities for increased collaboration between faculty on the main FAMU campus, specifically in Chemistry and Physics. The programs will also increase the number of graduate degrees awarded in STEM; an Area of Strategic Emphasis identified by the Board of Governors.

The MS&E program at FAMU and FSU will advance the State and Federal calls to increase competence in science, technology, engineering, and math (STEM) in upcoming generations and to promote interdisciplinary approaches to solve fundamental problems in a global environment. Specifically in Florida, the aerospace industry is an essential component of the State's economy. Further, the military and NASA drive the development of new materials because improved performance materials are paramount for them. As such, there are several federal research laboratories in the Panhandle region, including Eglin and Tyndall AFBs, the Naval Surface Warfare Center, and the Naval Air Station Pensacola, that need new, well-trained MS&E graduates in their workforce. In addition, many industries in Florida, like defense and aerospace contractors, need materials science and engineering research. With the advanced knowledge gained in materials science and related areas of chemistry and physics, graduates from the proposed program will be able to apply knowledge gained from understanding, developing, testing, and applying materials that will form the foundation for present and future technologies. They will also contribute to improving materials for existing technologies and create new materials that will spawn new technologies.

B. If the proposed program qualifies as a Program of Strategic Emphasis, as described in the Florida Board of Governors 2025 System Strategic Plan, please indicate the category.

- **Critical Workforce**
  - ☐ Education
  - ☐ Health
  - ☐ Gap Analysis
- **Economic Development**
  - ☐ Global Competitiveness
  - ☒ Science, Technology, Engineering, and Math (STEM)

☐ **Does not qualify as a Program of Strategic Emphasis.**

II. Strategic Plan Alignment, Projected Benefits, and Institutional Mission and Strength

A. Describe how the proposed program directly or indirectly supports the following:

- **System strategic planning goals (see link to the 2025 System Strategic Plan on the New Program Proposals & Resources webpage)**
- **the institution's mission**
- **the institution's strategic plan**

The MS&E programs contributes directly to several of the State University System (SUS) Strategic Planning Goals in the 2025 System Strategic Plan. The specific areas in which the master's in MS&E will impact or contribute are:

Teaching and Learning:

- Strengthen Quality and Reputation of the Universities
- Increase Degree Productivity & Program Efficiency. The proposed degree will increase degree productivity within the FAMU-FSU College of Engineering as a joint College and graduate degree production at FAMU.
- Increase the Number of Degrees Awarded in Programs of Strategic Emphasis. The program falls under the category of STEM; thereby, increasing the number of degrees awarded in areas of strategic emphasis and areas of high demand for employers.

Scholarship, Research and Innovation:

- Strengthen the Quality and Reputation of Scholarship, Research, and Innovation. Faculty within the program and related disciplines will be able to pursue additional grants from their research associated with the various areas of materials, such as, magnetic materials, materials for 3-D printing, nano biomaterials, multifunctional polymers, sensors for structural materials, catalysts, and electrolytes for batteries.

- Increase Research Activity and Attract More External Funding

The MS&E program is also consistent with FAMU's mission. Florida Agricultural and Mechanical University (FAMU) is an 1890 land-grant institution dedicated to the advancement of knowledge, resolution of complex issues and the empowerment of citizens. FAMU's distinction as a doctoral/research institution will continue to provide mechanisms to address emerging issues through local and global partnerships. Expanding upon the University's land-grant status, it will enhance the lives of constituents through innovative research, engaging cooperative extension, and public service.

In direct support of its mission, the proposed MS&E programs align with FAMU's dedication to the "advancement of knowledge and resolution of complex issues". Materials engineers and materials scientists "plan and carry out complex research projects, such as the development of new products and testing methods" (BLS, 2021). According to the Bureau of Labor Statistics, "the number of scientific research projects that involve multiple disciplines is increasing, and it is common for materials scientists to work on teams with other scientists, such as biologists, physicists, computer specialists, and engineers". Each of these areas are aligned with degree programs in areas of strategic emphasis and are offered at both FAMU and FSU.

Further, advances in materials science and engineering are steadily rising with the increase in building materials, human services, batteries, nanotechnology, etc. As these areas continue to emerge, graduates of FAMU's MS&E program will be equipped to handle complex problems utilizing creative thinking to address real world problems associated with the advances of materials science consistent with the mission.

Along with the Board of Governor's 2025 Strategic Plan and FAMU mission, the proposed MS&E programs aligns well with FAMU's goal for High Impact Research, Commercialization, Outreach, and Extension Services. Specific to Strategic Priority 3 of the FAMURising, the master's in MS&E will address the following goals:

- Goal 1: Expand and enhance cutting-edge research and creative scholarship for the benefit of the state of Florida, the nation, and the world
- Goal 2: Increase research productivity, commercialization and return on investment
- Goal 3: Increase the number of nationally recognized graduate programs

FAMU and FSU have faculty in STEM fields who will collaborate in the interdisciplinary MS&E master's program. At FAMU, faculty from engineering, physics, and chemistry will participate at the onset. As the program grows, additional faculty will be added to the program. Current faculty from both institutions have been successful writing proposals and receiving external funding to do cutting edge research. As the MS&E M.S. program will help attract additional graduate students, greater contributions to the SUS Strategic Planning Goals and the FAMU Strategic Plan are anticipated. Further, this program supports the FAMU and SUS missions of educating more diverse students in high-tech STEM fields to compete in the 21st century global economy.

B. Describe how the proposed program specifically relates to existing institutional strengths. This can include:

- **existing related academic programs**
- **existing programs of strategic emphasis**
- **institutes and centers**
- **other strengths of the institution**

FAMU-FSU College of Engineering ranks as the #2 doctoral-granting undergraduate engineering school in Florida by U.S. News and World Report. The College is also ranked #4 for graduate engineering among public schools in Florida. This is a testament of the strength of FAMU and FSU programs' strengths in areas of strategic emphasis. Additionally, FAMU and FSU faculty within the joint College and departmental faculty collaborating in materials science conduct high-quality research leading to sustainable solutions for today's economy.

MS&E faculty members and their students will have access to appropriate lab space and shared facilities in the National High Magnetic Field Laboratory (NHMFL). Faculty also utilize and conduct research in the NSF-CREST grant space within the NHMFL and within the High-Performance Materials Institute (HPMI) in Innovation Park. In addition, space is being remodeled in FAMU's Centennial Research Building for a recent new hire doing

materials related research. All these facilities (NHMFL, HPMI, and the Centennial Building) are adjacent to the FAMU-FSU College of Engineering.

FAMU has a strong record as a Top 100 producer of graduate degrees to minorities as evidenced in its rankings by Diverse Issues in Higher Education. In the 2019 publication of Diverse Issues, FAMU is ranked #28 for graduate degrees in engineering awarded to African Americans. Florida State University is ranked #98 in the production of engineering degrees awarded to Hispanics. Because the MS&E program will build on the academic strengths of both institutions and faculty teaching jointly in the FAMU-FSU College of Engineering, students will have increased exposure to diverse experiences to support high achievement in the classroom.

C. Provide the date the pre-proposal was presented to the Council of Academic Vice Presidents Academic Program Coordination (CAVP ACG). Specify whether any concerns were raised, and, if so, provide a narrative explaining how each concern has been or will be addressed.

The CAVP proposal for FAMU's proposed master's degree in Materials Science and Engineering was presented on September 2nd at the fall 2021 meeting. Members of the group voiced support for the program as an addition to the State University System and joint FAMU-FSU College of Engineering. No formal concerns were noted.

D. In the table below, provide a detailed overview and narrative of the institutional planning and approval process leading up to the submission of this proposal to the Board office. Include a chronology of all activities, providing the names and positions of both university personnel and external individuals who participated in these activities.

- **If the proposed program is a bachelor's level, provide the date the program was entered into the APPRiSe system, and, if applicable, provide narrative responding to any comments received from APPRiSe.**
- **If the proposed program is a doctoral-level program, provide the date(s) of the external consultant's review in the planning table. Include the external consultant's report and the institution's responses to the report as Appendix B.**

Planning Process

PLANNING PROCESS		
Date	**Participants**	**Planning Activity**
Planning activities to move MS&E from Graduate School to FAMU-FSU COE, which was needed to be able to create the joint FAMU-FSU MS&E program		
Dec. 19, 2019	Dean Gibson, Eric Hellstrom, Huckaba, Mark Riley	Met to discuss moving MS&E from the FSU Graduate school to the FAMU-FSU COE
Feb. and June, 2020	MS&E faculty members plus Dean Gibson, Huckaba, Mark Riley	All MS&E faculty members alerted by email about plans to move MS&E from the Graduate School to FAMU-FSU COE. MS&E faculty were asked for comments and concerns.
Summer and Fall 2020	Dean Gibson and FSU administration	Working to move MS&E from the Graduate School to FAMU-FSU COE
Jan. 1, 2021	FSU and FAMU-FSU COE administration	MS&E officially transferred from Graduate school to FAMU-FSU COE

PLANNING PROCESS		
Date	**Participants**	**Planning Activity**
Planning activities to create the FAMU MS&E M.S. program		
Sept. 28, 2021	Provost Maurice Edington, Dean Murray Gibson	Presentation to FAMU Provost by former Dean Gibson to formally move MS&E to FAMU-FSU COE, which would allow creating FAMU MS&E M.S. program.
July 20, 2021	FAMU-FSU COE Joint Council	Presentation to FAMU Provost by former Dean Gibson to the FAMU-FSU COE Joint council.
Aug. 16, 2021	Provost Maurice Edington Dean Murray Gibson, Eric Hellstrom, Director Program Faculty Institutional Level Committee (UPARC)	CAVP Proposals reviewed and approved by FAMU Internal Committee and Provost
Sept. 1, 2021	College of Science and Technology Dean, Richard Alo and administrative team Eri Hellstrom, Director Nelly Mateeva, Department Chair (Chemistry) Saha Bidhan, Department Chair, (Physics)	Discussion of feasibility of FAMU MS&E programs and potential collaborations from Chemistry and Physics departments
September 2, 2021	CAVP Academic Coordination Group	CAVP Pre-Proposal Approval
Sept. 3, 2021	Jaamel Ali, Prof. CBE Natalie Arnett, Prof. CBE Tarik Dickens, Prof. IME Subramanian Ramakrishnan, Prof. CBE Murray Gibson, Dean Eric Hellstrom, Director Sundra Kincey, Asst. VP of Program Quality	FAMU MS&E programs and potential collaborations from Chemistry and Physics departments
Sept. 7, 2021	FAMU Academic Affairs Leadership FAMU-FSU College of Engineering Administrators Program Faculty (Engineering, Chemistry, Physics)	Q&A with FAMU and Board of Governors Staff Members
Sept. 13, 2021	College of Science and Technology Dean, Richard Alo and administrative team Eri Hellstrom, Director Nelly Mateeva, Department Chair (Chemistry) Saha Bidhan, Department Chair, (Physics)	FAMU MS&E collaborative partner discussions
September/October 2021	President, Provost, Faculty Senate, University Curriculum Committee	Approval of MS&E Proposal by FAMU Internal Administrators and Committee
June 2022	FAMU Board of Trustees	Approval of MS&E Proposal by FAMU Board of Trustees

E. Provide a timetable of key events necessary for the implementation of the proposed program following approval of the program by the Board office or the Board of Governors, as appropriate, and the program has been added to the State University System Academic Degree Program Inventory.

Events Leading to Implementation

Date	Implementation Activity
June - July 2022	Board of Governors Staff Review for Addition to State University System Inventory
June – July 2022	Develop MOUs between collaborating departments
July - August 2022	Update internal systems to reflect new degree program
July – December 2022	Marketing of program to prospective students
Spring 2023	Enroll first cohort of students in MS&E program.

Institutional and State Level Accountability

III. Need and Demand

A. Describe the workforce need for the proposed program. The response should, at a minimum, include the following:

- **current state workforce data as provided by Florida's Department of Economic Opportunity**
- **current national workforce data as provided by the U.S. Department of Labor's Bureau of Labor Statistics**
- **requests for the proposed program from agencies or industries in your service area**
- **any specific needs for research and service that the program would fulfill**

Materials science experimental, computational, and theoretical research forms an important vehicle to create new materials and improve existing materials that underpin developing new technologies in medicine, energy, transportation, electronics, communications, information, building, construction, homeland security and national defense. Many major federal funding agencies, including the National Science Foundation, Department of Energy, Department of Defense, and NASA support large research programs in materials science and engineering. In addition, many companies employ materials in their products and need employees who are knowledgeable about materials science.

High technology industries have an increasing need for materials scientists, including in manufacturing, automotive, aerospace, catalysis, electronics, construction, medical science, and nanotechnology. The Bureau of Labor Statistics states that "Employment of materials engineers is projected to grow eight percent from 2020 to 2030" 1. Growth is expected to be particularly strong for materials scientists and engineers working on nanomaterials and biomaterials. Also, according to the Aerospace Industries Association, there will be a need for more people in the aerospace industries, including materials scientists, as baby boomers retire, and the industry creates more advanced designs with more outstanding capabilities and higher efficiencies.

Florida has a strong national presence in key economic sectors such as aerospace, defense, marine and space. Lockheed Martin, Boeing, Raytheon, Northrop Grumman, and General Dynamics – top aerospace/defense companies in the U.S. – all have substantial operations in Florida, and all employ materials scientists. New materials are key to advances in these industries, such as the carbon-fiber composites being used in military aircraft and the latest commercial Boeing and Air Bus planes. On the national level, well-known companies in which materials scientists and engineers play key roles include 3M, Apple, Alcoa, Boeing, Cummins, DuPont, Exxon Mobil, General Dynamics, GE, General Motors, HP, IBM, Intel, Lockheed Martin, Motorola, and Xerox. The MS&E graduates can also work in research and development in national labs, and industrial labs.

The increasing budget and scales of federal agencies' SBIR/STTR programs in MS&E fields have created and will continue to have a greater need for M.S. graduates in these

1 *https://www.bls.gov/ooh/architecture-and-engineering/materials-engineers.htm*

fields. Recent placements of M.S. and Ph.D. graduates from the FSU MS&E program show that the job-market is strong. In a recent survey of FSU MS&E graduates, they said their companies would be interested in hiring FAMU MS&E graduate students.

Creating the MS&E program will also enhance FAMU's ability, along with program faculty in the FAMU-FSU College of Engineering, to increase federal research funding, graduate student recruitment, and master's degree production. Over the past decade, federal research awards to interdisciplinary teams in materials areas have increased substantially. Already FAMU faculty associated with this proposal have won substantial NSF grants in materials-related areas and having the FAMU MS&E master's degree will provide additional opportunities for major funding from federal agencies.

Bureau of Labor Statistics data show that positions for MS&E graduates will continue to grow and MS&E graduates are well paid. Positions for master's graduates will likely increase, and salaries are expected to be higher for graduates with an advanced degree. The Bureau's data estimate that employment for materials engineers with at least a baccalaureate degree will grow between 3.9% and 12% over the next ten years from 2020 to 2030. The table below shows job growth projected by BLS by occupation aligned with the Materials Science CIP code 40.1001.

Table 1 - Bureau of Labor Statistics

Job Title	Employment Change Percent	Occupational Job Openings	Minimal Education Level	Median Wages
Architectural and Engineering Managers	4.1%	14,700	Bachelor's	$149,530
Materials Engineers	8.4%	1,800	Bachelor's	$95,640
Materials Scientists	3.9%	700	Bachelor's	$99,460
Engineering Teachers, Postsecondary	12.5%	9,300	Doctoral or Professional	$103,600

Growth in the State of Florida is more robust according to the Florida Department of Economic Opportunity. Employment change percent ranges from 11.7% - 14.8% for the years projected from 2021-2029 for the same occupations.

Table 2 - Florida Department of Economic Opportunity

Job Title	Employment Change Percent	Occupational Job Openings	Minimal Education Level	Median Wages
Architectural and Engineering Managers	14.8%	643	Bachelor's	$137,550
Materials Engineers	11.7	44%	Bachelor's	
Materials Scientists	Data Not Available	Data Not Available	Data Not Available	Data Not Available
Engineering Teachers, Postsecondary	Data Not Available	Data Not Available	Data Not Available	Data Not Available

According to O*NET, within the State of Florida, the highest annual median salary for Materials Engineers is in the Palm Bay-Melbourne-Titusville area, as shown in the accompanying table.

Location	Annual Low (10%)	Annual Q_L (25%)	Annual Median (50%)	Annual Q_U (75%)	Annual High (90%)
United States	$60,580	$76,650	$98,300	$127,110	$161,080
Florida	$48,850	$48,850	$82,070	$126,950	$162,630
Crestview-Fort Walton Beach-Destin, FL	$60,680	$77,500	$99,040	$126,780	$162,410
Jacksonville, FL	$62,360	$77,480	$97,090	$119,770	$123,210
Miami-Fort Lauderdale-West Palm Beach, FL	$59,630	$63,430	$82,310	$113,820	$128,420
Orlando-Kissimmee-Sanford, FL	$60,770	$79,890	$82,530	$122,650	$166,210
Palm Bay-Melbourne-Titusville, FL	$65,080	$91,000	$105,120	$130,720	$163,320

Survey data from O*NET indicates that about 48% new hires need a bachelor's to perform jobs in this occupation, 33% doctoral degree required, and 10% master's degree required. We surmise that with the higher number of positions needed for the doctoral degree, greater numbers of students will seek entry for master's level programs as a path to the doctorate. The graphs below show job postings in positions related to Materials Science and Engineering nationally for 2021.

Table 3 - MS&E Job Postings Requiring Advanced Degree

Target Occupations

*Filtered by the proportion of the national workforce in these occupations with a Master's degree or Doctoral or professional degree

94,336	+2.8%	$49.01/hr $101.9K/yr	7,683
Jobs (2021)*	% Change (2021-2026)*	Median Earnings	Annual Openings*

Occupation	2021 Jobs*	Annual Openings*	Median Earnings	Growth (2021 - 2026)*
Architectural and Engineering Managers	72,979	5,759	$71.87/hr	+2.88%
Cost Estimators	11,919	1,146	$31.99/hr	+1.40%
Materials Engineers	6,311	465	$45.98/hr	+4.50%
Materials Scientists	3,127	313	$47.82/hr	+1.50%

Table 4 - Top Posted Job Titles

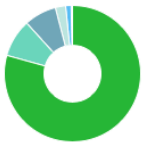
Job Title	Total/Unique (May 2021 - Apr 2022)	Posting Intensity	Unique Postings Trend (May 2021 - Apr 2022)
Engineering Managers	6,031 / 2,429	2 : 1	
Project Engineers	2,997 / 1,294	2 : 1	
Directors of Engineering	2,675 / 1,232	2 : 1	
Directors of Data Engineering	1,718 / 833	2 : 1	
Data Engineering Managers	1,905 / 807	2 : 1	
Chief Engineers	1,673 / 777	2 : 1	
Engineering Program Managers	1,424 / 564	3 : 1	
Materials Engineers	1,176 / 460	3 : 1	
Materials Scientists	1,306 / 410	3 : 1	
Project Engineering Managers	1,117 / 395	3 : 1	

Total/Unique (May 2021 - Apr 2022)

Opportunities to close the diversity gap also exist with the proposed program in Materials Science and Engineering offered jointly within the FAMU-FSU College of Engineering. The graph below depicts a breakdown of ethnicity for occupations associated with this discipline. FAMU can contribute to increase the number of minorities prepared for advanced entry into the profession, specifically increased numbers of African American graduates.

Table 5 - MS&E Occupation Race/Ethnicity Breakdown

Occupation Race/Ethnicity Breakdown



Race/Ethnicity	2021 Jobs	2021 Percent
White	350,347	79.3%
Asian	39,565	9.0%
Hispanic or Latino	33,864	7.7%
Black or African American	10,785	2.4%
Two or More Races	5,718	1.3%
American Indian or Alaska Native	1,066	0.2%
Native Hawaiian or Other Pacific Islander	376	0.1%

In addition to Florida industries as sources for occupations, a significant number of companies across the United States are seeking graduates with advanced degrees related to Materials Science and Engineering as evidenced by the graph below.

Table 6 - Total Companies Job Postings

Top Companies Posting Give Feedback

Company	Total/Unique (May 2021 - Apr 2022)	Posting Intensity	Unique Postings Trend (May 2021 - Apr 2022)
Capital One	3,044 / 1,416	2 : 1	
Boeing	2,872 / 1,156	2 : 1	
Raytheon Technologies	1,967 / 826	2 : 1	
Northrop Grumman	2,321 / 718	3 : 1	
Black & Veatch	797 / 623	1 : 1	
General Atomics	1,508 / 579	3 : 1	
Google	1,398 / 447	3 : 1	
L3Harris Technologies	778 / 423	2 : 1	
Facebook	890 / 420	2 : 1	
Apple	726 / 400	2 : 1	

Sources: Bureau of Labor Statistics, U.S. Department of Labor, *Occupational Outlook Handbook*, Materials Engineers, at https://www.bls.gov/ooh/architecture-and-engineering/materials-engineers.htm (visited *September 08, 2021*).

Florida Department of Economic Opportunity and O*NET
https://www.onetonline.org/link/localwages/17-2131.00?st=FL&g=Go (visited October 3, 2021)

B. Provide and describe data that support student demand for the proposed

program. Include questions asked, results, and other communications with prospective students.

Materials are used in almost everything we use in our modern society and new developments and advances in materials science underlie improvements in these technologies. For example, when people hear Intel, they think about Intel making the microprocessors that are the brains of computers. The unknown is that Intel is an applied materials science company whose core expertise is taking the drawings of the circuit diagrams for the latest microprocessor and transforming it into a complex 3-D maze of interconnected electronic components that are etched into a tiny chip of silicon that is the microprocessor in your computer. Fabricating microprocessors requires an assortment of materials and chemical processes that Intel is continually modifying and improving to make even faster microprocessors. This example shows where MS&E M.S. graduates are vital to the economy.

Engaging FAMU students in the MS&E M.S. program as part of the joint FAMU-FSU College of Engineering where the program already resides at Florida State University will address under-representation of African Americans amongst M.S. Materials Scientists and Engineers and in STEM fields in general. The FAMU-FSU College of Engineering is the #4 producer of PhDs to African Americans of all US engineering schools but cannot yet offer degrees in MS&E to FAMU students.

Several current students in FAMU's NSF CREST (Centers of Research Excellence in Science and Technology – Center for Additive Manufacturing) research center have inquired about when a FAMU MS&E program would be created. They wanted to do their materials-related research in the CREST and earn their graduate degree in MS&E, because this degree would more closely identify their expertise to potential employers, and it would better identify their formal education for the rest of their careers.

The College recently surveyed students in other HBCUs that had strong programs that could feed into MS&E, such as chemistry, physics, and undergraduate engineering programs. These surveys were sent to individual faculty members at the HBCUs for the faculty members to forward to the students. FAMU in the FAMU-FSU College of Engineering, chemistry and physics programs were also surveyed. Results are summarized below.

The following questions were asked in the survey with 36 individuals responding.

Table 7 - Please rate your level of interest in a graduate degree in Materials Science and Engineering to be potentially offered at Florida A&M University in the FAMU-FSU College of Engineering?

Very High	High	Somewhat High	Low	Not Interested
27.78% (N=10)	19.44% (N=7)	36.11% (N=13)	13.89% (N=5)	2.78% (N=1)

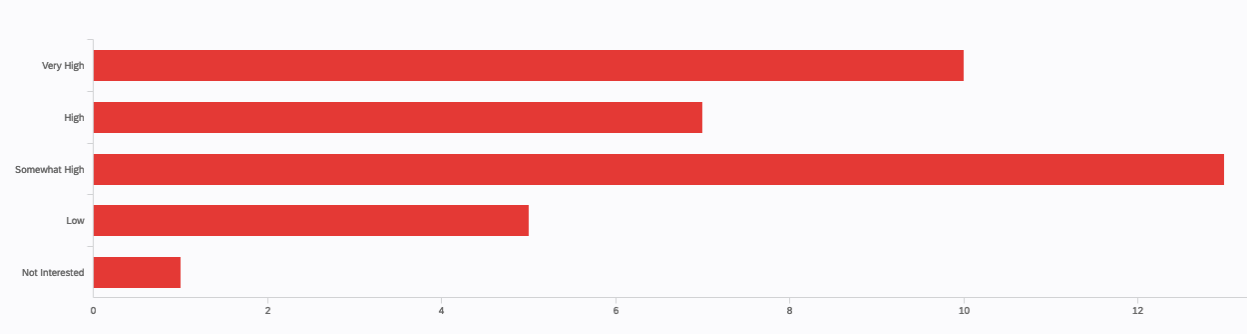


Table 8 - If a graduate degree in Materials Science and Engineering is offered, which level of degree would you likely apply?

Master of Science MS&E	Ph.D. MS&E	Both (completing MS first and then applying to the Ph.D.)
55.56% (N=20)	11.11% (N=4)	33.33% (N=12)

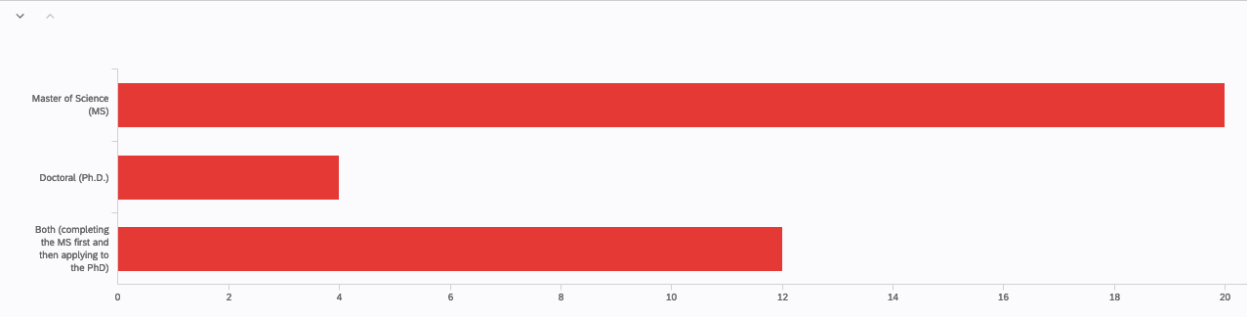


Table 9 - Likelihood of Applying to Master's MSE&E if it were launched in the next 1-2 years.

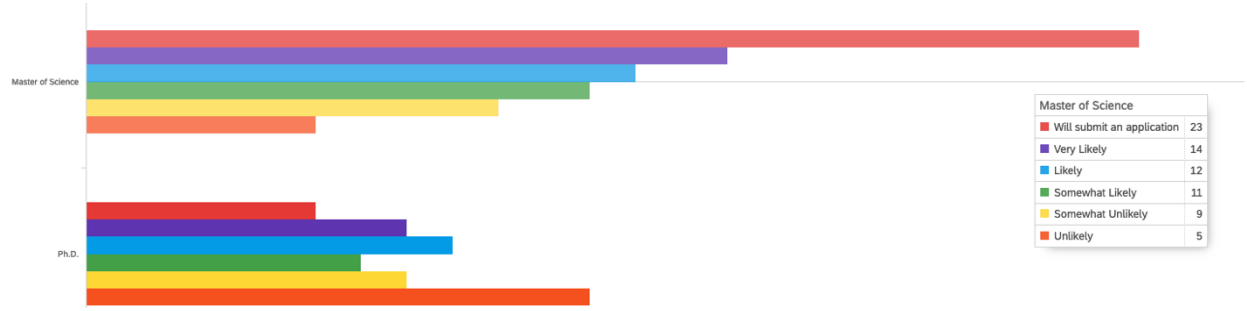


Table 10 - Likelihood of Applying to Ph.D. if launched in the next 1-2 years

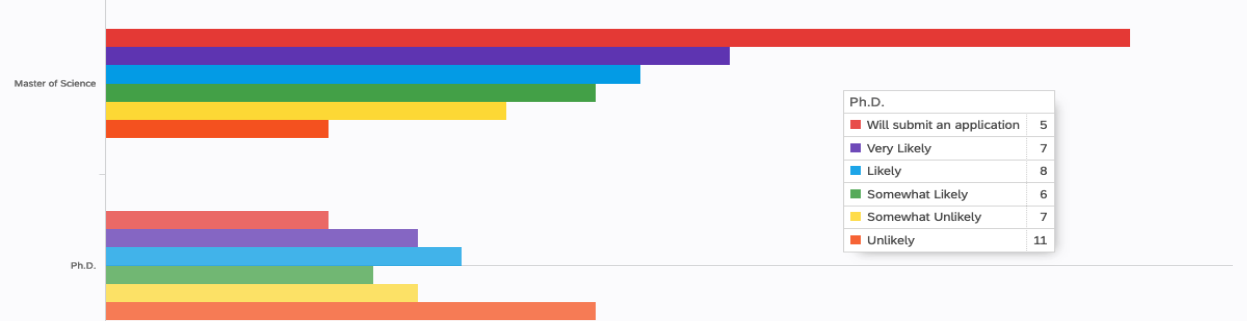
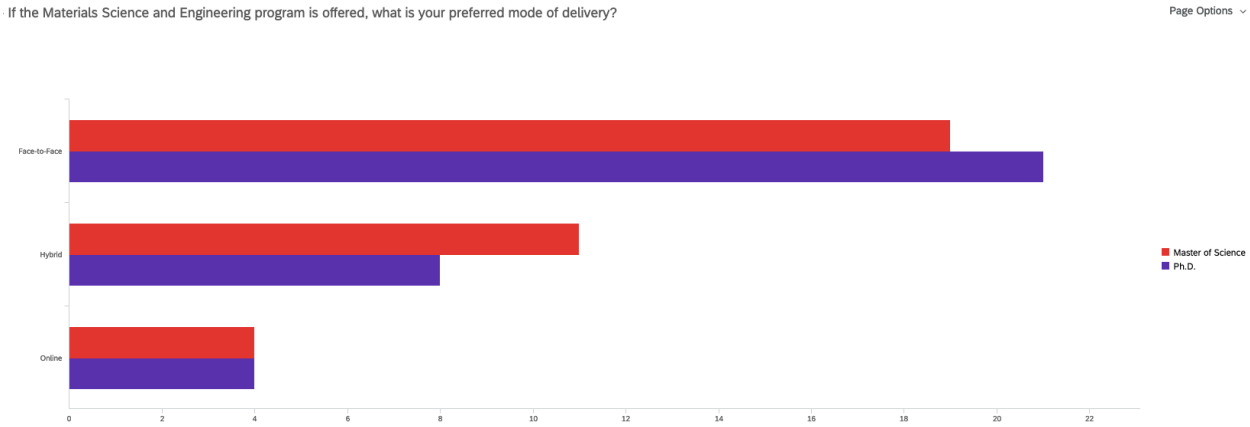


Table 11 - Preferred Mode of Delivery



C. Complete Appendix A – Table 1 (1-A for undergraduate and 1-B for graduate) with projected student headcount (HC) and full-time equivalents (FTE).

- **Undergraduate FTE must be calculated based on 30 credit hours per year**
- **Graduate FTE must be calculated based on 24 credit hours per year**

In the space below, provide an explanation for the enrollment projections. If students within the institution are expected to change academic programs to enroll in the proposed program, describe the anticipated enrollment shifts and impact on enrollment in other programs.

Year One

New students (N=3) for the master's program are anticipated from graduates of the FAMU-FSU College of Engineering or related undergraduate programs at FAMU and FSU. After full implementation and development of marketing strategies, the program anticipates growing the program modestly each year until it reaches at least ten students by year five.

Year Two

In year two, we expect to enroll five (N=5) students for the master's program. The five students are expected to come primarily from comparable undergraduate programs at FAMU and FSU (N=3), baccalaureate students from private institutions within the State of Florida (N=1) and baccalaureate students from Florida public universities (N=1).

Year Three

In year three, we plan to enroll approximately six (N=6) graduate students for the master's in Materials Science and Engineering program in year three. The six students are expected to come from comparable undergraduate programs at FAMU and FSU (N=3); undergraduate students from private institutions within the State of Florida or graduates from Florida public universities (N=2), and possibly one out-of-state student.

Year Four

We plan to enroll approximately eight (N=8) graduate students for the master's in Materials Science and Engineering program in year four. The eight students are expected to come from comparable undergraduate programs at FAMU and FSU (N=3); undergraduate students from private institutions within the State of Florida or graduates from Florida public universities (N=2); out-of-state students (N=2), and international students (N=1).

Year Five

We plan to enroll approximately ten (N=10) graduate students for the master's MS&E program in year five. The ten students are expected to come from comparable undergraduate programs at FAMU and FSU (N=3); undergraduate students from private institutions within the State of Florida or graduates from f-state students (N=2), and international students (N=2).

D. Describe the anticipated benefit of the proposed program to the university, local community, and the state. Benefits of the program should be described both quantitatively and qualitatively.

Numerous reasons exist to offer a joint program in MS&E between FAMU and FSU, particularly as the program already exists within the FAMU-FSU College of Engineering. In 2011, then Provost Harris wrote in her support letter for the FSU MS&E Ph.D. proposal (see Appendix E) that it would be beneficial for FAMU and FSU to cooperate in MS&E in the future. If implemented, the program will have multiple benefits to FAMU, FSU, the Panhandle region, the State of Florida, and the Nation that includes the following:

- Provide a means to recruit students interested in studying MS&E and create a way to educate and train them to earn an M.S. in a broad, interdisciplinary manner.
- Build on the sizable investments FAMU and FSU have made in start-up packages and infrastructure support for faculty members researching materials-related areas.
- Offer a new STEM program relatively inexpensively.
- Increase FAMU-FSU College of Engineering research visibility.
- Provide increased opportunities for FAMU and FSU to secure greater funding in materials research, particularly large-scale, interdisciplinary grants. Over the past decade, federal research awards to interdisciplinary teams in materials areas have increased substantially.
- Address the critical education need to produce more engineers within the United States and Florida, especially in the areas of materials.
- Contribute to research, economic development, and job creation in the Panhandle region and across the State.
- Increase the Nation's technical capability by attracting and enabling additional research and highly trained researchers for new product development.
- Help address underrepresentation of minorities in STEM disciplines, engineering in particular. The FAMU-FSU College of Engineering has already demonstrated progress in this area by being the number four producer of Ph.D.'s to African Americans of all US engineering schools.

E. If other public or private institutions in Florida have similar programs that exist at the four- or six-digit CIP Code or in other CIP Codes where 60 percent of the coursework is comparable, identify the institution(s) and geographic location(s). Summarize the outcome(s) of communication with appropriate personnel (e.g., department chairs, program coordinators, deans) at those institutions regarding the potential impact on their enrollment and opportunities for possible collaboration in the areas of instruction and research.

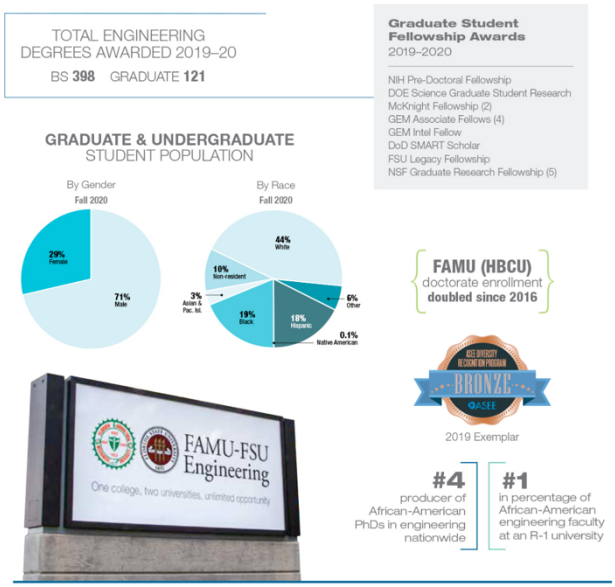
Input from the Council of Academic Vice Presidents Coordination Group suggested that demand is available for materials scientists and materials engineers nationally and within the State of Florida. A discussion regarding the addition of a program at FAMU as part of the program offerings within the joint FAMU-FSU College of Engineering was held including a review of enrollment and degree productivity for the last five years (shown below) within the SUS.

Table 12 - SUS Degree Productivity (Materials Science and Materials Engineering)

Institution	2020	2019	2018	2017	2016	Total by Institution
Florida International University	4	2	2	5	7	**20**
Florida State University	0	1	0	2	2	**5**
University of Central Florida	9	4	8	6	12	**39**
University of Florida	45	66	69	94	57	**331**
University of South Florida	19	12	13	19	7	**70**
Grand Total	**77**	**85**	**177**	**126**	**85**	**550**

As part of the joint College, collaborations between FAMU and FSU will occur organically. Collaborations with other institutions may also result due to the interdisciplinary nature of the program and research opportunities available to faculty.

F. Describe the process for the recruitment and retention of a diverse student body in the proposed program. If the proposed program substantially duplicates a program at FAMU or FIU, provide a letter of support from the impacted institution(s) addressing how the program will impact the institution's ability to attract students of races different from that which is predominant on the FAMU or FIU campus. The institution's Equal Opportunity Officer shall review this Section of the proposal, sign, and date the additional signatures page to indicate that all requirements of this section have been completed.



In accordance with FAMU's Non-Discriminatory Policy Statement, "each member of the University community is permitted to work or attend class in an environment free from any form of discrimination including race, religion, color, age, disability, sex, sexual harassment, sexual orientation, gender identity, gender expression, marital status, national origin, and veteran status". As an HBCU, FAMU has a population of students that are primarily traditionally underrepresented students.

Florida State has a population of majority students and a significant minority representation. As such, the proposed program situated within the joint FAMU-FSU College of Engineering is in a unique position to attract students from various backgrounds, races, and ethnicity as well as center itself to increase gender representation within the STEM disciplines. As evidence of its

commitment to diversity, the FAMU-FSU College of Engineering earned a Bronze Award and Exemplar Status from the American Society of Engineering Education (ASEE) in the inaugural year of the ASEE Diversity Recognition Program. The college is one of only two engineering programs in Florida to earn the distinctions.

Initial efforts of the program will be to focus on existing partnerships from member institutions of the Florida-Georgia Louis B. Stokes Alliance for Minority Participation. This Alliance has several member and co-member community colleges and several four-year institutions without graduate programs. Additional recruitment efforts will focus on internal campaigns to recruit highly qualified undergraduate students locally at FAMU and FSU with a specific focus in Chemistry, Physics, and Engineering departments. As this program is one of few offered at HBCUs, FAMU and FSU will join efforts to attract students nationally from other HBCUs across the U.S.

Digital media will be used to advertise the program on FAMU, FSU, and FAMU's NSF-CREST websites. Email campaigns will also be conducted to increase awareness of the program to highly populated enrollment areas for both FAMU and FSU. During the discussion of the proposed program with the Council of Academic Vice Presidents Coordination Group, Florida International University posed no concerns for the addition of the program at FAMU to be delivered collaboratively with FSU as part of the joint FAMU-FSU College of Engineering.

IV. Curriculum

A. Describe all admission standards and all graduation requirements for the program. Hyperlinks to institutional websites may be used to supplement the information provided in this subsection; however, these links may not serve as a standalone response. For graduation requirements, please describe any additional requirements that do not appear in the program of study (e.g., milestones, academic engagement, publication requirements).

MS&E will follow FAMU's admission standards with the following additional requirements.

Admission Criteria for the M.S. in MS&E

- An earned bachelor's degree from a regionally accredited U.S. institution, or a comparable degree from an international institution, with a minimum 3.0 (on a 4.0 scale) grade point average (GPA) in all work attempted while registered as an upper-division undergraduate student working towards a bachelor's degree; or
- A graduate degree from a regionally accredited U.S. institution, or a comparable degree from an international institution.
- GRE test scores with the following requirements: Quantitative exam be in the 75th or higher percentile; Verbal exam be in the 55th or higher percentile.
- International students whose first language is not English are required to take an English language exam. Acceptable scores are 80 total on the Internet-based TOEFL examination or 6.5 on the IELTS exam.
- Three (3) letters of recommendation

MS&E specific requirements

- Undergraduate or graduate degree in a STEM field.
- Submit a statement of professional goals
- Three letters of recommendation that assess the student's capabilities to do graduate research.

Graduation Criteria for the M.S. in MS&E

M.S. thesis

- Students must pass a minimum of 30 credits of which a minimum of 24 credits must be letter graded and a minimum of 6 credits must be in M.S. research.
- Students must pass all of the required letter-graded coursework with a minimum 3.0 GPA. In addition to meeting the university requirement to maintain an overall GPA of 3.0 or above, MS&E students need to achieve a grade of "B" or better in each core course. Students not achieving a "B" must either retake the course or take another core course in a different topic area that will be selected by MS&E in consultation with the instructor of the core course in which the student did not achieve at least a "B."
- Students must write a thesis, which must be an original work and will serve in part to demonstrate the student's ability to carry out research. On completion, the thesis will be defended orally in front of the student's research committee.

M.S. non-thesis

- Students must pass a minimum of 30 credits of which a minimum of 27 credits must be letter graded and 3 credits may be in no-letter-graded courses.
- Students must pass all of the required letter-graded coursework with a minimum 3.0 GPA. In addition to meeting the university requirement to maintain an overall GPA of 3.0 or above, MS&E students need to achieve a grade of "B" or better in each core course. Students not achieving a "B" must either retake the course or take another core course in a different topic area that will be selected by MS&E in consultation with the instructor of the core course in which the student did not achieve at least a "B."
- Students must do an oral presentation on a topic of their choice related to materials science in the materials science seminar series.

B. Describe the specific expected student learning outcomes associated with the proposed program and include strategies for assessing the proposed program's learning outcomes. If the proposed program is a baccalaureate degree, include a hyperlink to the published Academic Learning Compact and the document itself as Appendix C.

Expected Student Learning Outcomes are:

(1) Ability to demonstrate a thorough knowledge of MS&E: Students graduating with an M.S. in MS&E must demonstrate an understanding of a range of topics in MS&E and must also demonstrate the ability to carry out meaningful, independent research.

Assessment Plan: This learning outcome will be assessed by the student performance in the core courses, an oral defense of the thesis. The evaluation will be based on the

following measurements: (1) at least 75% of all M.S. students pass their core courses; and (2) at least 80% pass their thesis defense.

(2) Ability to present their work in an oral or a poster presentation: Students graduating with an M.S. in MS&E will be able to orally communicate their research work to others in the field.

Assessment Plan: This learning outcome will be assessed by the student performance by participation in the MS&E ISS (Interdisciplinary Seminar Series), in the thesis defense, and, if possible, in an oral or poster presentation at a scientific conference. The evaluation will be based on the following measurements: (1) at least 80% of the students will pass their thesis defense; (2) all students will have given at least one presentation in the MS&E seminar series; and (3) if possible, give an oral or poster presentation at a scientific conference in their field.

(3) Ability to communicate through the written medium. Students graduating with an M.S. in MS&E will be able to communicate their work to others in the field through journal articles.

Assessment plan: This learning outcome will be assessed by at least 50% of the students completing a paper and submitting it to a journal or a technical conference before graduating.

(4) Ability to function as an independent scientist/engineer. Students graduating with an M.S. in MS&E must demonstrate an ability to carry out research tasks, collect data, and analyze data.

Assessment Plan: This learning outcome will be assessed by the student's performance on the semester-long assistantship evaluation forms. At least 80% of the students in the program will have satisfactory semester-long evaluations.

C. If the proposed program is an AS-to-BS capstone, provide evidence that it adheres to the guidelines approved by the Articulation Coordinating Committee for such programs, as outlined in State Board of Education Rule 6A-10.024. Additionally, please list the prerequisites, if any, and identify the specific AS degrees that may transfer into the proposed program.

☒ **Not applicable to this program because it is not an AS-to-BS Capstone.**

D. Describe the curricular framework for the proposed program, including the following information where applicable:

- **total numbers of semester credit hours for the degree**
- **number of credit hours for each course**
- **required courses, restricted electives, and unrestricted electives**
- **a sequenced course of study for all majors, concentrations, tracks, or areas of emphasis**

The FAMU MS&E program will become an integral part of the existing FSU MS&E program offered in the joint college. The curriculum will be identical for FAMU and FSU students. In the first year, the curriculum will use courses in the existing FSU MS&E curriculum. FAMU students will be able to take FSU courses and FSU students will be able to take FAMU courses through the existing FAMU-FSU cooperative agreement (see Appendix F).

Students entering the program with a B.S. degree (or equivalent) will be required to a take a minimum of 30 credits including at least 24 credits of letter-graded courses and at least 6 credits of thesis research for the M.S. thesis option or at least 27 credits of letter-graded courses and may take 3 credits of non-letter-graded courses for the M.S. thesis option. All M.S. students will also take the Interdisciplinary Seminar Series (0 credits) the entire time they are in MS&E. The letter-graded credits are described below.

M.S. thesis option

24 credits (minimum) of letter-graded courses

- Four core courses (minimum 12 credits)
    - Three (3) Fundamental Core Courses: One course from each of these areas
        - Survey of Materials
        - Thermodynamics
        - Solid state science for materials scientists/engineers
    - One (1) Elective Core Courses - One course from either of these areas
        - Survey of Synthesis and Processing
        - Characterization of Materials
- Four (4) Elective Specialization Courses (minimum 12 credits)

6 credits (minimum) of thesis research

M.S. non-thesis option

27 credits (minimum) of letter-graded courses

- Four core courses (minimum 12 credits)
    - Three (3) Fundamental Core Courses - One course from each of these areas
        - Survey of Materials
        - Thermodynamics
        - Solid state science for materials scientists/engineers
    - One (1) Elective Core Courses: - One course from either of these areas
        - Survey of Synthesis and Processing
        - Characterization of Materials
- Five (5) Elective Specialization Courses (minimum 15 credits)

3 credits maximum of non-letter-graded courses

Fundamental Core Courses (9 total cr) – Students must take a course in each of the three areas.

Survey of materials – This topic includes an introduction to advanced materials, biomaterials, nanomaterials, and/or topics in materials chemistry, and is covered in several existing courses in mechanical engineering, in chemistry and biochemistry, and in biological science. Incoming MS&E students will have a wide variety of backgrounds. The survey course provides fundamental understanding about materials these students need for the other MS&E courses. This topic area can be taught by faculty members in Chemical Engineering, Chemistry, and Mechanical Engineering. This course deals with the wide variety of basic properties of ceramics, steels, optical, magnetic, and electrical materials.

- *Typically, ECH 5934 (3 cr) – Special Topics in Chemical Engineering: Chemical Engineering Materials*

Thermodynamics – This topic concerns the fundamental properties of thermodynamics, as applied to materials science. Existing courses in chemical and biomedical engineering, chemistry, and physics cover this topic. Although each of these courses is based on the same set of fundamental equations, the examples used in each course is based on what is most important for the course's home department. A course dedicated to Thermodynamics for Materials Science has been created for MS&E students. This course deals with energy terms that determine the stability of solid materials and the tendency for reactions to occur.

- *EML 5930 (3 cr) – Special Topics in Mechanical Engineering: Thermodynamics for Materials Science.*

Solid state science for materials scientists/engineers - This topic covers the essential areas of structural, thermal, electronic, and magnetic properties of materials, including superconducting, magnetic, semiconducting, and ferroelectric materials of strong current technological interest. This course is an introduction to a large variety of materials characterization techniques that have been developed and are currently used in materials science research. It also provides the fundamental background in band theory to understand electronic, optical, and magnetic properties of solid materials.

- *PHZ 5475 (3 cr) - Materials Characterization*

Elective Core courses (3 total cr) - Students must take one course from one of the following two areas:

Survey of synthesis and processing. - This topic addresses the synthesis of materials in bulk, thin film, amorphous, single crystals; morphologies and their transformation into structures for measurement; applications in technology and commercialization. The two courses listed below cover the same basic synthesis topics. EIN 5930 emphasizes a variety of synthesis techniques for a different material systems. EML 5182 focuses on synthesis of composite materials.

- *EIN 5930 3 cr) – Special Topics in Industrial Engineering: Synthesis and Processing of Advanced Materials*
- *EML 5182 (3 cr) – Composite Materials Engineering*

Characterization of materials. - This topic covers materials measurement, including optical, physical, electronic, magnetic, resonant and scattering methods, and microstructural probes. The two courses listed below cover the same basic information about how to characterize materials. The differences are that the main emphasis in EMA 5514 focuses on using electron microscopy to characterize materials, whereas EML 5930 is broader than EMA 5514 and examines several different methods to characterize the microstructures of materials.

- *EMA 5514 (3 cr) – Electron Microscopy*
- *EML 5930 (3 cr) – Special Topics in Mechanical Engineering: Microstructures of Materials*

Interdisciplinary Seminar Series – Students take this zero-credit seminar every semester they are in MS&E.

The seminar course will be offered by FAMU and FSU faculty to provide students with an opportunity to obtain information on advances in materials research though presentations by visiting scientists and from FAMU and MS&E faculty. Students will learn and practice presentation skills in this seminar. In addition to technical topics, this seminar series will have talks on business related topics to help prepare the students to take leadership roles as they move from the university setting to industry and society. The seminar will serve as a forum for MS&E faculty members who wish to recruit MS&E students, and so some of these seminar sessions will be set aside to allow multiple faculty members to make short presentations advertising their research programs.

- *ISC 5937 (0 cr) – Interdisciplinary Seminar Series – MS&E*

Elective specialization courses (12 or 15 total cr depending on the M.S. option the student is pursuing)

For the M.S. thesis students, these courses are selected by the student and their advisor with the goal of providing the most benefit to the student's research. For M.S. non-thesis students, the courses are chosen by consultation between the student and the director of MS&E based on the student's interests.

See Section IV.E. for a list of the elective specialization courses.

Suggested course sequence for a student entering MS&E entering in a fall semester. The sequence also shows when other actions, such as selecting an advisor and taking required exams need to be done.

M.S. – thesis option		
------ Year 1 ------		
Fall	**Spring**	**Summer**
• **2 Required Core courses** • **1 Elective Specialization course** • **ISS seminar**	• **1 Required Core course** • **1 Elective Core course** • **1 Elective Specialization course** • **ISS seminar** • **Choose research advisor by end**	• **Research**

	of Spring semester	
------ Year 2 ------		
Fall	**Spring**	**Summer**
• 1 Elective Specialization courses • Research • ISS seminar	• 1 Elective Specialization course • Research • ISS seminar • Graduate	• Graduated

M.S. – non-thesis option		
------ Year 1 ------		
Fall	**Spring**	**Summer**
• 2 Required Core courses • 1 Elective Specialization course • ISS seminar	• 1 Required Core course • 1 Elective Core course • 1 Elective Specialization course • ISS seminar	• No courses
------ Year 2 ------		
Fall	**Spring**	**Summer**
• 3 Elective Specialization courses • 1 Non-letter graded course • ISS seminar • Graduate	• Graduated	• Graduated

E. Provide a brief description for each course in the proposed curriculum.

Survey of materials – This topic includes an introduction to advanced materials, biomaterials, nanomaterials, and/or topics in materials chemistry, and is covered in several existing courses in mechanical engineering, in chemistry and biochemistry, and in biological science. Incoming MS&E students will have a wide variety of backgrounds. The survey course provides fundamental understanding about materials these students need for the other MS&E courses. This topic area can be taught by faculty members in Chemical Engineering, Chemistry, and Mechanical Engineering. This course deals with the wide variety of basic properties of ceramics, steels, optical, magnetic, and electrical materials.

Thermodynamics – This topic concerns the fundamental properties of thermodynamics, as applied to materials science. Existing courses in chemical and biomedical engineering, chemistry, and physics cover this topic. Although each of these courses is based on the same set of fundamental equations, the examples used in each course is based on what is most important for the course's home department. A course dedicated to Thermodynamics for Materials Science has been created for MS&E students. This course deals with energy terms that determine the stability of solid materials and the tendency for reactions to occur.

Solid state science for materials scientists/engineers - This topic covers the essential areas of structural, thermal, electronic, and magnetic properties of materials, including superconducting, magnetic, semiconducting, and ferroelectric materials of strong current technological interest. This course is an introduction to a large variety of materials

characterization techniques that have been developed and are currently used in materials science research. It also provides the fundamental background in band theory to understand electronic, optical, and magnetic properties of solid materials.

Survey of synthesis and processing. - This topic addresses the synthesis of materials in bulk, thin film, amorphous, single crystals; morphologies and their transformation into structures for measurement; applications in technology and commercialization. The two courses listed below cover the same basic synthesis topics. EIN 5930 emphasizes a variety of synthesis techniques for a different material systems. EML 5182 focuses on synthesis of composite materials.

Characterization of materials. - This topic covers materials measurement, including optical, physical, electronic, magnetic, resonant and scattering methods, and microstructural probes. The two courses listed below cover the same basic information about how to characterize materials. The differences are that the main emphasis in EMA 5514 focuses on using electron microscopy to characterize materials, whereas EML 5930 is broader than EMA 5514 and examines several different methods to characterize the microstructures of materials.

Chemistry of Materials - This course introduces materials chemistry, with strong emphasis on the interdisciplinary nature of materials research. The course provides an overview of various classes of materials, including the synthesis and characterization of materials, their structural and physical properties, and how those properties relate to specific applications. (CHM 5715 3 cr)

Electrochemistry - Instrumentation and techniques in electrochemistry, including such topics as electrode processes, potentiometry, voltammertry, and coulometry. (CHM 5153 3 cr).

Polymer Chemistry - The course covers polymers (plastics) which encompass nearly every facet of our daily lives, and the rich variety of properties and functions that characterize these materials, which is deeply seeded in the chemistry and architecture of their macromolecular structure. This course broadly surveys these materials, the current state of the field, and the modern challenges and research opportunities within it. (CHM 5450 3 cr)

Characterization of Materials I - This course deals with microscopic and diffraction methods used for structural characterization of materials, as well as with transport and magnetic measurements. Recommended for students involved in materials research. (CHM 5716 3 cr)

Topics in Materials Chemistry II - Introduction to materials chemistry, focusing on the structure, properties, and functions of polymers, organic and soft materials, and bio-inspired materials. This course is intended for graduate students involved in materials research. (CHM 5718 3 cr)

Chemical and Physical Characterization of Biopolymers - Course covers biopolymer types and conformations; solution properties of biopolymers; macromolecular equilibria;

hydrodynamic behavior; determination of size and shape; biopolymer separations; introduction to biological spectroscopy. (BCH 5745 3 cr).

Advanced Polymer Physical Science and Engineering - This course is a graduate introduction to static and dynamic polymer physics, including models of chains and macroscopic properties. (ECH 5820 3 cr)

Polymer Science and Engineering - The course offers graduates fundamental concepts and structure-property relationships of polymeric materials. (ECH 5828 3 cr)

Solid State Sensors - This course covers the fabrication of solid-state sensors, their characterization, operational principles, and applications for acoustic, mechanical, magnetic, radiation, thermal, chemical, and biologic sensors. (EEE 5333 3 cr)

Semiconductor Device Theory - This course covers elementary quantum physics, energy-band theory, carrier properties, theory of p-n junctions, optoelectronics diodes, bipolar junction transistors, and field-effect transistors. **(EEE 6353 3 cr)**

Introduction to Energy Storage - This course provides students with an overview on energy storage technologies and devices with focus on electrochemical storages including advanced rechargeable batteries, electrochemical capacitors, and fuel cells. **(EEL 5075 3 cr)**

Photovoltaics: This course educates students in the design and applications of solar energy technology. This course focuses on theoretical fundamentals of solar energy conversion, types of solar cells and their operations, optical engineering, and energy storage and distribution systems. The course covers solar energy insolation and global energy needs, current trends in photovoltaic energy engineering, solar cell material science, design and installation of solar panels for residential and industrial applications and connections to the national grid and cost analysis of the overall system. (**EEL 5284** 3 cr)

Applied Optimization - The course offers student fundamental of Heuristic Optimization and its applications in engineering design, production and materials research. (ESI 5408 3 cr)

Technology Entrepreneurship and Commercialization - This course provides students with a hands-on educational experience proposing and analyzing technology-based ideas for development as a product and introducing the product into the market. (EIN 5445 3 cr)

Advanced Composite Engineering Topics - A survey course on advanced composite topics, including fabrication process modeling and simulation, high temperature resins and composites, fiber preform and liquid composite molding (LCM), electrical and EMI shielding properties of composite materials. (EIN 5930 3 cr)

Composite Materials Engineering - This course offers students fundamental knowledge of constitutional materials, interface, fabrication and basic mechanical behaviors of composite materials. (EMA 5182 3 cr)

Mechanical Metallurgy - This course offers students fundamentals of metallurgy. (EMA 5226 3 cr)

Materials for Energy Systems - Introduction to several classes of Materials that are used in systems that produce, store or transfer energy. It concentrates on three main areas in which energy is transformed to useful sources: solar to chemical energy by photocatalysis, nuclear to electric energy by controlled nuclear reactions, and chemical to electrical energy in solid oxide fuel cells. (EML 5930 3 cr)

Applied Superconductivity - This course offers students an introduction to superconductivity, superconducting materials, and the technology challenges related to their processing and application. (EML 5072 3 cr)

Continuum Mechanics - This course offers student fundamentals of continuum mechanics. (EML 5611 3 cr)

Introduction to Advanced Materials - The course provides the fundamentals of the science and practical uses of materials. (EML 5930 3 cr)

Computational Physics Laboratory - This course introduces students to the use of computers to solve computationally intensive problems, including basic instruction in physics problem solving using numerical solutions to differential equations, numerical integration, Monte Carlo, partial differential equations, linear algebra, distributed processing and symbolic algebra. The course also provides instruction in computational techniques and software development skills and practice in using network and software development tools including telnet, ftp, spreadsheets, databases, code management systems, and the World Wide Web. (PHZ 5156 3 cr)

Materials Characterization - This course is an introduction to a large variety of materials characterization techniques that have been developed and are currently used in materials science research. (PHZ 5475 3 cr)

Condensed Matter Physics I - Crystal structure phonons, electron in metals, semiconductors, magnetism, ferroelectrics, and liquid crystals. (PHZ 5491 3 cr)

Condensed Matter Physics II - Elementary excitations in solids, the many-body problem, quantum fluids and superconductivity, magnetism, dielectrics, collective effects in fluids. (PHZ 5492 3 cr)

Applied Computational Science I - This course provides students with high-performance computational tools necessary to investigate problems arising in science and engineering, with an emphasis on combining them to accomplish more complex tasks. A combination of coursework and lab work provides the proper blend of theory and practice with problems culled from the applied sciences. Topics include numerical

solutions to ODEs and PDEs, data handling, interpolation and approximation, and visualization. (ISC 5315 3 cr)

Applied Computational Science II - This course provides students with high-performance computational tools necessary to investigate problems arising in science and engineering, with an emphasis on combining them to accomplish more complex tasks. A combination of coursework and lab work provides the proper blend of theory and practice with problems culled from the applied sciences. Topics include mesh generation, stochastic methods, basic parallel algorithms and programming, numerical optimization, and nonlinear solvers. (ISC 5316 3 cr)

F. For degree programs in medicine, nursing, and/or allied health sciences, please identify the courses that contain the competencies necessary to meet the requirements identified in Section 1004.08, Florida Statutes. For teacher preparation programs, identify the courses that contain the competencies necessary to meet the requirements outlined in Section 1004.04, Florida Statutes.

☒ **Not applicable to this program because the program is not a medicine, nursing, allied health sciences, or teacher preparation program.**

G. Describe any potential impact on related academic programs or departments, such as an increased need for general education or common prerequisite courses or increased need for required or elective courses outside of the proposed academic program. If the proposed program is a collaborative effort between multiple academic departments, colleges, or schools within the institution, provide letters of support or MOUs from each department, college, or school in Appendix D.

As a graduate program, general education courses are not required. However, because this program is interdisciplinary, departments outside of the FAMU-FSU College of Engineering will participate on both FAMU's and FSU's main campuses. Enrollment in courses for the MS&E program will be shared with students from collaborating disciplines. Increased enrollment in shared courses because of the M.S. in MS&E is expected to have minimal impact on existing courses. The majority of graduate courses have ample enrollment caps of 20-30 students so there is space for MS&E students to enroll in these courses.

H. Identify any established or planned educational sites where the program will be offered or administered. If the proposed program will only be offered or administered at a site(s) other than the main campus, provide a rationale.

This program will be offered as part of the FAMU-FSU College of Engineering located in Tallahassee Florida. Students will take classes on the FAMU main campus, in the FAMU-FSU College of Engineering, and on the FSU main campus. Students will do their research where their advisor has their research labs on the FAMU main campus, in buildings in the FAMU-FSU Collee of Engineering, and in research buildings in Innovation Park (in Tallahassee) including FAMU's Centennial building and the National High

Magnetic Field Laboratory.

I. Describe the anticipated mode of delivery for the proposed program (e.g., face-to-face, distance learning, hybrid). If the mode(s) of delivery will require specialized services or additional financial support, please describe the projected costs below and discuss how they are reflected in Appendix A – Table 3A or 3B.

The courses will be delivered in the traditional face-to-face manner at the FAMU-FSU College of Engineering, FAMU main campus, or on the FSU campus as part of the cooperative agreement between the two universities.

J. Provide a narrative addressing the feasibility of delivering the proposed program through collaboration with other institutions, both public and private. Cite any specific queries made of other institutions with respect to shared courses, distance/distributed learning technologies, and joint-use facilities for research or internships.

The Master of Science in Materials Science and Engineering will be offered jointly between FAMU and FSU as part of the joint College. No additional institutions will be involved in the course offerings at this time.

K. Describe any currently available sites for internship and/or practicum experiences. Describe any plans to seek additional sites in Years 1 through 5.

☒ Not applicable to this program because the program does not require internships or practicums.

V. Program Quality Indicators - Reviews and Accreditation

A. List all accreditation agencies and learned societies that would be concerned with the proposed program. If the institution intends to seek specialized accreditation for the proposed program, as described in Board of Governors Regulation 3.006, provide a timeline for seeking specialized accreditation. If specialized accreditation will not be sought, please provide an explanation.

Undergraduate programs in MS&E are accredited through ABET, which accredits engineering programs. The FAMU-FSU College of Engineering does not have an undergraduate program in MS&E. There are no accreditation agencies for graduate programs (M.S. or Ph.D.) in Materials Science and Engineering.

B. Identify all internal or external academic program reviews and/or accreditation visits for any degree programs related to the proposed program at the institution, including but not limited to programs within academic unit(s) associated with the proposed degree program. List all recommendations emanating from the reviews and summarize the institution's progress in implementing those recommendations.

The FSU MS&E program, which the FAMU MS&E M.S. program will join, underwent an internal FSU Quality Enhancement Review (QER) in 2018. A summary of the reviewer's comments is provided below, and his full report is in the Appendix.

CURRICULUM

- *Strengths*: Well designed and flexible curriculum; good use of weekly seminar; excellent first-year research rotation
- *Weaknesses*: Core course content is not under control of MS&E program. With the movement of the MS&E programs to the FAMU-FSU College of Engineering, the program director and faculty have increased oversight of the program, including course offerings.

STUDENTS

- *Strengths*: Good numbers of applications; high quality students admitted to program; strong positive student view of program and faculty; strong sense of community among students
- *Weaknesses*: Unpredictability of elective course offerings is a concern for some students; large variation in opportunities for teaching assistantships

FACULTY

- *Strengths*: High quality affiliated faculty with positive international reputations, good external rewards, research support, and publication profiles; cluster hire in materials science (early 2010's)
- *Weaknesses*: There are no faculty appointments dedicated to MS&E

RESOURCES

- *Strengths*: Unique research strengths in the National High Magnetic Field Lab, High Performance Materials Institute, and the Applied Superconductivity Center; excellent laboratory facilities; good access to labs by students; first-year fellowships for research rotations (Note: these fellowships are only for

Ph.D. students)

- *Weaknesses*: There is no direct source of financial support; administrative support is low if program growth is desired. Dr. Eric Hellstrom serves as the program director for the both the master's and doctoral programs at FSU that now reside within the FAMU-FSU College of Engineering. He will continue in this role with the implementation of the program at FAMU.

C. For all degree programs, discuss how employer-driven or industry-driven competencies were identified and incorporated into the curriculum. Additionally, indicate whether an industry or employer advisory council exists to provide input for curriculum development, student assessment, and academic-force alignment. If an advisory council is not already in place, describe any plans to develop one or other plans to ensure academic-workforce alignment.

The graduate MS&E program does not have an industry advisory council. This section describes how faculty members obtain research for cutting-edge topics, which mainly supports Ph.D. student, but also supports M.S. thesis students. To get funding, an MS&E faculty member has to write a competitive proposal to a federal agency or industry that addresses a significant scientific problem in some area of materials science and engineering. Proposals that are funded address cutting-edge research in areas that are important to the federal agency or industry. The MS&E M.S. thesis students work on research topics the scientific and technical communities have identified as important, relevant, and timely.

The MS&E master's core courses provide students with a general background that underpins the discipline of MS&E. Each student takes a different set of elective specialization courses that they choose in consultation with their research advisor to aid with their research. New elective specialization courses relevant for MS&E are being developed at a rate of about one every two to three years. These courses are typically based on topics that are relevant to the faculty member's research who develops the course.

VI. Faculty Participation

A. Use Appendix A – Table 2 to identify existing and anticipated full-time faculty who will participate in the proposed program through Year 5, excluding visiting or adjunct faculty. Include the following information for each faculty member or position in Appendix A – Table 2:

- **the faculty code associated with the source of funding for the position**
- **faculty member's name**
- **highest degree held**
- **academic discipline or specialization**
- **anticipated participation start date in the proposed program**
- **contract status (e.g., tenure, tenure-earning, or multi-year annual [MYA])**
- **contract length in months**
- **percent of annual effort that will support the proposed program (e.g., instruction, advising, supervising)**

This information should be summarized below in narrative form. Additionally, please provide the curriculum vitae (CV) for each identified faculty member in Appendix E.

The table below provides a list of faculty participating in the program and anticipated efforts for years one and five. For this proposal, only information for FAMU faculty is included as the program at FSU has been in existence for more than ten years. However, it should be noted that faculty from the joint College employed at FSU will continue to contribute to the program along with faculty from collaborating departments.

Faculty Code	Name	Highest Degree Held	Academic Discipline or Specialty	Program Start Date	Contract Status	Contract Length	Percent Effort
A	Ali, Jamel	Ph.D.	Chemical and Biomedical Engineering	Spring 2023			5%
A	Arnett, Natalie	Ph.D.	Chemical and Biomedical Engineering/ Chemistry	Spring 2023			5%
A	Dickens, Tarik	Ph.D.	Industrial and Manufacturing Engineering	Spring 2023			5%
A	Johnson, Lewis	Ph.D.	Physics	Fall 2023	Tenured	12-month	5%
A	Kattel, Shyam	Ph.D.	Physics	Fall 2023	Tenure-earning	9-month	5%
A	Ramakrishnan, Subramanian	Ph.D.	Chemical and Biomedical Engineering	Spring 2023			5%
A	Senevirathne, Keerthi	Ph.D.	Chemistry	Fall 2023	Tenured	9-month	5%
A	Thirunavukkuarasu, Komalavalli	Ph.D.	Physics	Fall 2023	Tenure-earning	9-month	5%
A	Weatherford, Physics	Ph.D.	Physics	Fall 2023	Tenured	12-month	5%

B. Provide specific evidence demonstrating that the academic unit(s) associated with the proposed program have been productive in teaching, research, and service. Such evidence may include trends over time for average course load, FTE productivity, student HC in major or service courses, degrees granted, external funding attracted, and other qualitative indicators of excellence (e.g., thesis, dissertation, or research supervision).

Graduate faculty members in the proposed MS Materials Science and Engineering have been productive in teaching, research and grant acquisition. The proposed MS&E is an interdisciplinary program mainly that is independent of any existing academic unit. Faculty that will teach in the MS&E currently teach in related programs in the FAMU-FSU College of Engineering, FAMU Physics, and FAMU Chemistry departments. The departments as a whole have been productive in enrollment, degrees awarded in STEM degrees across engineering, physics, and chemistry. The table below provides a brief synopsis and evidence that FAMU faculty contributing to the program are research active. It shows that from July 2015 through June 2021 they brought in more than $4.12 M in research funding and there are two new grants that start in FY 22 that will bring in another $1.5 M over the next three years.

Name	**Department**	**Professional Publications**	**Externally-funded research activities – 2015 through 2021[1]**
Ali, Jamel	Chemical and Biomedical Engineering	8 Refereed Journal Articles 15 Proceedings	1 @ $79,705 from NSF
Arnett, Natalie	Chemical and Biomedical Engineering/ Chemistry	4 Refereed Journal Articles 15 Proceedings	1 @ $49,999[2] from NSF
Dickens, Tarik	Industrial and Manufacturing Engineering	6 M.S. Theses 1 Ph.D. Dissertation 29 Refereed Journal Articles 5 Proceedings 1 Book Chapter	2 @ $238,996 from NSF and MI Tech U
Johnson, Lewis	Physics	15 Refereed Journal Articles 45 Conference Presentations 4 MS Theses 5 PhD Dissertations	
Kattel, Shyam	Physics	58 Refereed Journal Articles 1 Proceeding	1 @ $2,154,718 from NSF
Ramakrishnan, Subramanian	Chemical and Biomedical Engineering	2 M.S. Theses 3 Ph.D. Dissertation 18 Refereed Journal Articles 2 Book Chapters	5 @ $2,154,718 from NSF

Name	Department	Professional Publications	Externally-funded research activities – 2015 through 2021[1]
Senevirathne, Keerthi	Chemistry	1 M.S. Thesis 4 Refereed Journal Articles	2 @ $150,000 from NSF HBCU and UP
Thirunavukkuarasu, Komalavalli	Physics	11 Refereed Journal articles	4 @ $1,353,323 from DOD and ONR
Weatherford, Charles	Physics	2 M.S. Thesis 3 Ph.D. Dissertations 2 Books 4 Book Chapters 95 Refereed Journal Articles 144 Proceedings	3 @$9.5 million from National Nuclear Security Agency

[1]Funding data are through June 30, 2021.
[2]Arnett has two NSF grants that started in FY 22 that total $1.5 M over the next 3 years.

In addition to research, FAMU collaborating faculty in Physics and Chemistry are active at the graduate level in teaching. Collective graduate enrollment for physics and chemistry are shown below for the last five years.

Table 13 - Graduate Enrollment Chemistry and Physics

	Fall 2017	Fall 2018	Fall 2019	Fall 2020	Fall 2021
Beginning Graduate	12	12	7	8	7
Advanced Graduate	14	15	13	14	10
Total	26	27	20	22	17

VII. Budget

A. Use Appendix A – Table 3A or 3B to provide projected costs and associated funding sources for Year 1 and Year 5 of program operation. In narrative form, describe all projected costs and funding sources for the proposed program(s). Data for Year 1 and Year 5 should reflect snapshots in time rather than cumulative costs.

The budget in Table 3A provides projected costs of the MS&E program and associated funding sources. The total budget for Year One is $95,231.90. For this proposal, only information for FAMU faculty are included because the FAMU program will become joint with the existing FSU program, which has been in existence for more than ten years. It should be noted that faculty from the joint College employed at FSU will continue to contribute to the program along with faculty from collaborating FSU departments. No additional costs will be incurred on the FSU side from implementing the FAMU program.

Nine full-time faculty are expected to participate in Year One from FAMU from disciplines in engineering, physics, and chemistry. Reallocated dollars from the percent effort of those faculty equate to a total of $50,232. Of the reallocated faculty salaries, approximately $40,647 will be allocated from the Dean's budgets from the FAMU-FSU College of Engineering and College of Science and Technology at FAMU. The remaining dollars of $9585 will come from contracts and grants. By year five, reallocation dollar will be stable at $50,232. However, an increase in assistantship is expected.

It is anticipated that new thesis-level master's students will be supported in year one with at least $45,000 dedicated to assistantships. This amount of funding could support at least three full-time master's students at $15,000 annually. By year five, the goal is to increase the level of support for at least ten full-time students at $150,000 collectively. The funding source for the assistantships will be contracts and grants as students will be supported by faculty research grants. The total cost to the program in year five is $200,232.

B. Use Appendix A – Table 4 to show how existing Education & General (E&G) funds will be reallocated to support the proposed program in Year 1. Describe each funding source identified in Appendix A – Table 4, and provide a justification below for the reallocation of resources. Describe the impact the reallocation of financial resources will have on existing programs, including any possible financial impact of a shift in faculty effort, reallocation of instructional resources, greater use of adjunct faculty and teaching assistants, and explain what steps will be taken to mitigate such impacts.

The overall budget for FAMU's contribution to the FAMU-FSU College of Engineering is $1,034.205. Approximately $22,691 will be reallocated to the Materials Science and Engineering program, leaving a total of $1,011,514.

The overall budget for the FAMU College of Science and Technology is $10.5. Approximately, $27,541 will be reallocated to the Materials Science and Engineering for faculty from chemistry and physics to support the program, leaving a total of $10,472,459.

C. If the institution intends to operate the program through continuing education, seek approval for market tuition rate, or establish a differentiated graduate-

level tuition, as described in Board of Governors Regulation 8.002, provide a rationale and a timeline for seeking Board of Governors' approval.

☒ Not applicable to this program because the program will not operate through continuing education, seek approval for market tuition rate, or establish a differentiated graduate-level tuition

D. Provide the expected resident and non-resident tuition rate for the proposed program for both resident and non-resident students. The tuition rates should be reported on a per credit hour basis, unless the institution has received approval for a different tuition structure. If the proposed program will operate as a continuing education program per Board of Governors Regulation 8.002, please describe how the tuition amount was calculated and how it is reflected in Appendix A – Table 3B.

This program will charge graduate tuition rates as shown below.

Fees

Registration and tuition fees are established by the Board of Education and the FAMU Board of Trustees as required by the Florida Legislature. These fees are subject to change without notice. The current credit hour fee schedule is as follows:

	IN-STATE	OUT-OF-STATE
Undergraduate	$151.78	$549.80
Graduate	405.67	1,022.04
Law	455.86	1,097.89

E. Describe external resources, both financial and in-kind support, that are available to support the proposed program, and explain how this amount is reflected in Appendix A – Table 3A or 3B.

A major source of support for students doing the M.S.-thesis is funds for research assistantships paid from faculty members' research grants. The table below shows that the faculty members associated with this proposal are successful raising research funds, which includes support for a graduate student to do research in the faculty member's lab. These grants pay the student's stipend and also pay for in-state tuition. Beyond individual faculty support, the program administrators and faculty will aid students seeking fellowships from organizations such as the Graduate Education for Minorities (GEM) Fellowship Program. M.S.-non-thesis students will typically self-pay for the degree.

VIII. Non-Faculty Resources

A. Describe library resources currently available to implement and/or sustain the proposed program through Year 5 below, including but not limited to the following:

- **the total number of volumes and serials available in the discipline and related disciplines**
- **all major journals that are available to the university's students**

The Library Director must sign the additional signatures page to indicate that they have review Sections VIII.A. and VIII.B.

Existing library collections in engineering, physics and chemistry are suitable to the materials Science and Engineering program. Library collections contain archival resources, including journal back files, as well as current resources that support a curriculum in Materials Science and Engineering directly and indirectly through interdisciplinary collections in the sciences and technology. Library collections in these disciplines are well balanced and suitable to support all levels of teaching and research including advanced study. The following table shows library holdings in support of Materials Science and Engineering.

Current FAMU Libraries' Holdings in Support of Materials Science and Engineering

Resources	Engineering	Materials Science
Books	146,232	56,781
Electronic Books	133,174	55,634
Electronic Journals	5,941	342
Electronic databases	40	40

Major journals that are available to Materials Science and Engineering students

- ACS Biomaterials Science and Engineering
- Acta Crystallographica Section B: Structural Science, Crystal Engineering and Materials
- Advanced Materials for Science and Engineering (ICAMSE), International Conference on
- Advances in Materials Science and Engineering
- Advances in Science and Technology
- Annual Cumulative Index for CSA Journals in Materials Science & Technology, Engineering, Computer Science, Conference Papers
- Biobase Material Science and Engineering (BMSE), International Conference on
- Environmental Engineering Science
- Foundations of Materials Science & Engineering
- Hazardous Waste & Hazardous Materials
- IEEE Transactions on Device and Materials Reliability

- IOP Conference Series: Materials Science and Engineering
- Iranian Journal of Science and Technology, Transactions of Mechanical Engineering
- Journal of Ultra Scientist of Physical Sciences - Section B (Physics, Geology, Nano Technology Engineering, Bio Sciences, Material Science Management)
- Key Engineering Materials
- Materials Science & Engineering
- Materials Science & Engineering A: Structural Materials: Properties, Microstructure and Processing
- Materials Science and Engineering B: Solid-State Materials for Advanced Technology
- Materials Science and Engineering C
- Materials Science and Engineering: R: Reports
- Materialwissenschaft und Werkstofftechnik
- Modelling and Simulation in Materials Science and Engineering
- Supramolecular Science

B. Discuss any additional library resources that are needed to implement and/or sustain the program through Year 5. Describe how those costs are reflected in Appendix A – Table 3A or 3B.

☒ Not applicable to this program because no additional library resources are needed to implement or sustain the proposed program.

C. escribe any specialized equipment and space currently available to implement and/or sustain the proposed program through Year 5.

Each of the faculty members already has the specialized research equipment in their research laboratory needed to carry out high-quality research. Often this was purchased as part of a new faculty member's startup package. The faculty members also have access to shared equipment within their department. In addition, faculty members associated with the High-Performance Materials Institute and the National High Magnetic Field Laboratory, which are located in Innovation Park adjacent to the FAMU-FSU College of Engineering, have access to shared equipment in these two research facilities.

- KLA iNano
- Nanoscience Scanning Electron Microscopy (SEM)
- Laser nScrypt 3Dn-300 nScrypt 3Dn-450
- Meltio M450
- MTS 858 test machine
- NozTek extruder
- Thinky Planetary Mixer
- Hot presses (6"x6", 12"x12" and 24"x24")
- Thermogravimetric Analyzer, TGA Q50, TA Instrument
- HDR TA Instrument
- Anton Paar MCR 302 Rheometer - Qty 2
- TA instruments Differential Scanning Calorimeter (DSC)
- Brookhaven Instruments Dynamic Light Scattering
- Wyatt Instruments Static and Dynamic Light Scattering (Multi Angle)
- Wyatt Instruments Laser Light Scattering Viscometric Detector
- Wyatt Instruments Differential Refractometer
- Wyatt Instruments Laser Light Scattering Zeta Potential Machine (Mobius)

- Agilent 1200 High Performance Liquid Chromatography with UV Vis detector
- LS Instruments Diffusing Wave Spectroscopy
- 8 Glove Glovebox
- Qsense E4 Quartz Crystal Microbalance
- Beckman Coulter Benchtop Centrifuge
- nScrypt 3Dn-300 BAT bioprinter
- Optical Microscope
- Schlenk Line/Fume Hood
- Nikon Eclipse Ti2
- Prime 95b sCMOS Camera for microscope
- MagnebotiX AG MFG-100 System
- Azur Light Systems 5W
- 1064nm single-frequency laser
- Acousto-optical deflector system
- Excella E-25 Incubated Shaker
- Labconco Purifier® Logic®+ Class II A2 Biosafety Cabinets (4’ and 5’)
- Accu-jet Pro Pipet Controllers
- Stirring Hotplates
- Analytical Balance
- Kepco BOP 100-2DL802E 200 W Bipolar Power Supplies
- National Instruments NI PCIe-6363
- X Series DAQ
- Qsonica 700-Watt sonicator system
- ThorLabs Nexus Optical Table (4' x 8')
- VWR CO2 Incubator
- VWR -80C Freezer Chest
- Thermo Scientific Orion Star A211 pH Benchtop Meter
- VWR Standard Heavy-Duty Vortex Mixer
- PURELAB flex Water Purification System
- VWR Standard Series Refrigerators and Freezer
- GentleMACS™ dissociator
- Beckman Coulter Avanti JXN-30 Floor Centrifuge
- Beckman Coulter Allegra® X-14 Series Benchtop Centrifuge
- Eppendorf 5425 Centrifuge
- Nanodrop OneC Spectrophotometer
- SunP Biotech 3D BIOMAKER Bioprinter
- Cell Link INKREDIBLE+ Bioprinter
- Anton Paar MCR 302 Rheometer
- Broadband Fourier Transform Infrared Spectrometer (Bruker vertex 70v)
- Optical microscope cryostat (Cryo Industries)
- Diamond anvil cells
- Nitrogen-purged glove box (Vacuum Technology Inc.)
- Computer-controlled micromanipulator
- Photoluminescence setup (HR 4000 Ocean Optics).
- High voltage electrospinning setup
- Shimadzu GC-8A Gas chromatograph
- Photocatalytic testing setup including a Newport Xenon lamp & power supply
- WaveDriver 10 Potentiostat Bundle with Rotating Disk Electrodes
- Schlenk lines
- Tube and box furnaces
- Fume hoods
- Wet-chemistry stations
- Local Workstation computers (two 8 cores HP workstation and one 32 core HP workstation)

Software licenses * Vienna Ab-Initio Simulation Package (VASP) * Material Studio * Materials Design

D. Describe any additional specialized equipment or space that will be needed to implement and/or sustain the proposed program through Year 5. Include any projected Instruction and Research (I&R) costs of additional space in Appendix A – Table 3A or 3B. Costs for new construction should be provided in response to Section X.E. below.

☒ Not applicable to this program because no new I&R costs are needed to implement or sustain the program through Year 5

E. If a new capital expenditure for instructional or research space is required, indicate where this item appears on the university's fixed capital outlay priority list. Appendix A – Table 3A or 3B includes only I&R costs. If non-I&R costs, such as indirect costs affecting libraries and student services, are expected to increase as a result of the program, describe and estimate those expenses in narrative form below. It is expected that high enrollment programs, in particular, would necessitate increased costs in non-I&R activities.

☒ Not applicable to this program because no new capital expenditures are needed to implement or sustain the program through Year 5.

F. Describe any additional special categories of resources needed to operate the proposed program through Year 5, such as access to proprietary research facilities, specialized services, or extended travel, and explain how those projected costs of special resources are reflected in Appendix A – Table 3A or 3B.

☒ Not applicable to this program because no additional special categories of resources are needed to implement or sustain the program through Year 5.

G. Describe fellowships, scholarships, and graduate assistantships to be allocated to the proposed program through Year 5 and explain how those are reflected in Appendix A – Table 3A or 3B.

It is anticipated that the majority of the M.S. thesis students will be funded as research assistants by individual faculty members from their research grants. The M.S. non-thesis students are expected to be self-paying for their degree.

☐ Not applicable to this program because no fellowships, scholarships and/or graduate assistantships will be allocated to the proposed program through Year 5.

IX. Required Appendices

The appendices listed in tables 1 & 2 below are required for all proposed degree programs except where specifically noted. Institutions should check the appropriate box to indicate if a particular appendix is included to ensure all program-specific requirements are met. Institutions may provide additional appendices to supplement the information provided in the proposal and list them in Table 4 below.

Table 1. Required Appendices by Degree Level

Appendix	Appendix Title	Supplemental Instructions	Included? Yes/No	Required for Degree Program Level		
				Bachelors	Masters/ Specialist	Doctoral/ Professional
A	Tables 1-4		X	X	X	X
B	Consultant's Report and Institutional Response					X
C	Academic Learning Compacts	Include a copy of the approved or proposed Academic Learning Compacts for the program	Not Applicable	X		
D	Letters of Support or MOU from Other Academic Units	Required only for programs offered in collaboration with multiple academic units within the institution	Forthcoming	X	X	X
E	Faculty Curriculum Vitae		X	X	X	X
F	Common Prerequisite Request Form	This form should also be emailed directly to the BOG Director of Articulation prior to submitting the program proposal to the Board office for review.	Not Applicable	X		
G	Request for Exemption to the 120 Credit Hour Requirement	Required only for baccalaureate degree programs seeking approval to exceed the 120 credit hour requirement	Not Applicable	X		
H	Request for Limited Access Status	Required only for baccalaureate degree programs seeking approval for limited access status	Not Applicable	X		

Table 2. Additional Appendices

Appendix	Appendix Title	Description
I	FAMU Provost Letter to FSU	Letter of Support for FSU MS&E

APPENDIX A – TABLES 1 – 4

APPENDIX A

TABLE 1-B

PROJECTED HEADCOUNT FROM POTENTIAL SOURCES

(Graduate Degree Program)

Source of Students (Non-duplicated headcount in any given year)*	Year 1 HC	Year 1 FTE	Year 2 HC	Year 2 FTE	Year 3 HC	Year 3 FTE	Year 4 HC	Year 4 FTE	Year 5 HC	Year 5 FTE
Individuals drawn from agencies/industries in your service area (e.g., older returning students)	0	0	0	0	0	0	0	0	0	0
Students who transfer from other graduate programs within the university**	0	0	0	0	0	0	0	0	0	0
Individuals who have recently graduated from preceding degree programs at this university	3	3	3	3	3	3	3	3	3	3
Individuals who graduated from preceding degree programs at other Florida public universities	0	0	1	1	1	1	1	1	3	3
Individuals who graduated from preceding degree programs at non-public Florida institutions	0	0	1	1	1	1	1	1	2	2
Additional in-state residents***	0	0	0	0	0	0	0	0	0	0
Additional out-of-state residents***	0	0	0	0	1	1	2	2	1	1
Additional foreign residents***	0	0	0	0	0	0	1	1	1	1
Other (Explain)***	0	0	0	0	0	0	0	0	0	0
Totals	**3**	**3**	**5**	**5**	**6**	**6**	**8**	**8**	**10**	**10**

* List projected annual headcount of students enrolled in the degree program. List projected yearly cumulative ENROLLMENTS instead of admissions.

** If numbers appear in this category, they should go DOWN in later years.

*** Do not include individuals counted in any PRIOR category in a given COLUMN.

APPENDIX A

Table 2

Anticipated Faculty Participation

Faculty Code	Faculty Name or "New Hire" Highest Degree Held Academic Discipline or Specialty	Rank	Contract Status	Initial Date for Participation in Program	Mos. Contract Year 1	FTE Year 1	% Effort for Prg. Year 1	PY Year 1	Mos. Contract Year 5	FTE Year 5	% Effort for Prg. Year 5	PY Year 5
A	Jamel Ali, Ph.D. Chemical and Biomedical Engineering			Spring 2023	9	0.75	0.05	0.04	9	0.75	0.05	0.04
A	Natalie Arnett, Ph.D. Chemical and Biomedical Engineering and Chemistry			Spring 2023	9	0.75	0.05	0.04	9	0.75	0.05	0.04
A	Tarik Dickens, Ph.D. Industrial and Manufacturing Engineering			Spring 2023	9	0.75	0.05	0.04	9	0.75	0.05	0.04
A	Lewis Johnson, Ph.D. Physics			Fall 2023	12	1.00	0.05	0.05	12	1.00	0.05	0.05
A	Shyam Kattel, Ph.D. Physics			Fall 2023	9	0.75	0.05	0.04	9	0.75	0.05	0.04
A	Subramanian Ramakrishnan Chemical and Biomedical Engineering			Spring 2023	9	0.75	0.05	0.04	9	0.75	0.05	0.04
A	Keerthi Senvirathne Physics			Fall 2023	9	0.75	0.05	0.04	9	0.75	0.05	0.04
A	Komalavalli Thirunavukkuarasu Physics			Fall 2023	9	0.75	0.05	0.04	9	0.75	0.05	0.04
D	Charles Weatherford Physics			Fall 2023	12	1.00	0.05	0.05	9	0.75	0.05	0.04
	Total Person-Years (PY)							**0.31**				**0.31**

Faculty Code	Code Description	Source of Funding	PY Workload by Budget Classification Year 1		Year 5
A	Existing faculty on a regular line	Current Education & General Revenue	0.26		0.26
B	New faculty to be hired on a vacant line	Current Education & General Revenue	0.00		0.00
C	New faculty to be hired on a new line	New Education & General Revenue	0.00		0.00
D	Existing faculty hired on contracts/grants	Contracts/Grants	0.05		0.05

APPENDIX A

Table 2

Anticipated Faculty Participation

E	New faculty to be hired on contracts/grants	Contracts/Grants	0.00		0.00
F	Existing faculty on endowed lines	Philanthropy & Endowments	0.00		0.00
G	New faculty on endowed lines	Philanthropy & Endowments	0.00		0.00
H	Existing or new faculty teaching outside of regular/tenure-track line course load	Enterprise Auxiliary Funds	0.00		0.00
		Overall Totals for	**0.31**		**0.31**

APPENDIX A

TABLE 3A

EROLLMENT AND GROWTH

PROJECTED COSTS AND FUNDING SOURCES

Institutions should not edit the categories or budget lines in the table below. This table is specific to state-funded (E&G) programs, and institutions are expected to explain all costs and funding sources in Section VII.A. of the proposal. Detailed definitions for each funding category are located at the bottom of the table.

Budget Line Item	Reallocated Base* (E&G) Year 1	Enrollment Growth (E&G) Year 1	New Recurring (E&G) Year 1	New Non-Recurring (E&G) Year 1	Contracts & Grants (C&G) Year 1	Philanthropy/ Endowments Year 1	Other Funding Year 1 - Please Explain in Section VII.A. of the Proposal	**Subtotal Year 1**	Continuing Base** (E&G) Year 5	New Enrollment Growth (E&G) Year 5	Other*** (E&G) Year 5	Contracts & Grants (C&G) Year 5	Philanthropy/ Endowments Year 5	Other Funding Year 5 - Please Explain in Section VII.A. of the Proposal	**Subtotal Year 5**
Salaries and Benefits (Faculty)	40,647	0	0	0	9,585	0	0	**$50,232**	40,647	0	0	9,585	0	0	**$50,232**
Salaries and Benefits (A&P and USPS)	0	0	0	0	0	0	0	**$0**	0	0	0	0	0	0	**$0**
OPS (including assistantships & fellowships)	0	0	0	0	45,000	0	0	**$45,000**	0	0	0	150,000	0	0	**$150,000**
Programmatic Expenses****	0	0	0	0	0	0	0	**$0**	0	0	0	0	0	0	**$0**
Total Costs	**$40,647**	**$0**	**$0**	**$0**	**$54,585**	**$0**	**$0**	**$95,232**	**$40,647**	**$0**	**$0**	**$159,585**	**$0**	**$0**	**$200,232**

*Identify reallocation sources in Table 4.

**Includes recurring E&G funded costs ("reallocated base," "enrollment growth," and "new recurring") from Years 1-4 that continue into Year 5.

***Identify if non-recurring.

****include library costs, expenses, OCO, special categories, etc.

Faculty and Staff Summary

Total Positions	Year 1	Year 5
Faculty (person-years)	0.31	0.31
FTE (A&P and USPS)	0	0

Calculated Cost per Student FTE

	Year 1	Year 5
Total E&G Funding	$40,647	$40,647
Annual Student FTE	3	10
E&G Cost per FTE	13548.95417	4064.7

Table 3 Column Explanations

Reallocated Base* (E&G)	1	E&G funds that are already available in the university's budget and will be reallocated to support the new program. Please include these funds in the Table 4 – Anticipated reallocation of E&G funds and indicate their source.
Enrollment Growth (E&G)	2	Additional E&G funds allocated from the "Student and Other fees Tust Fund" contingent on enrollment increases.
New Recurring (E&G)	3	Recurring funds appropriated by the Legislature to support implementation of the program.
New Non-Recurring (E&G)	4	Non-recurring funds appropriated by the Legislature to support implementation of the program. Please provide an explanation of the source of these funds in the budget section (section VII.A.) of the proposal. These funds can include initial investments, such as infrastructure.
Contracts & Grants (C&G)	5	Contracts and grants funding available for the program.
Philanthropy Endowments	6	Funds provided through the foundation or other Direct Support Organizations (DSO) to support the program.
Continuing Base** (E&G)	7	Includes the sum of columns 1, 2, and 3 over time.
New Enrollment Growth (E&G)	8	See explanation provided for column 2.
Other*** (E&G)	9	These are specific funds provided by the Legislature to support implementation of the program.
Contracts & Grants (C&G)	10	See explanation provided for column 5.
Philanthropy Endowments	11	See explanation provided for column 6.
Other Funding	12	Any funding sources not already covered in any other column of the table. Please provide an explanation for any funds listed in these columns in the narrative for Section VII.A. of the proposal.

APPENDIX A

TABLE 4

ANTICIPATED REALLOCATION OF EDUCATION GENERAL FUNDS*

Program and/or E&G account from which current funds will be reallocated during Year 1	Base before reallocation	Amount to be reallocated	Base after reallocation
FAMU-FSU College of Engineering	1,034,205	22,691	**$1,011,514**
College of Science and Technology	10,500,000	27,541	**$10,472,459**
	0	0	**$0**
	0	0	**$0**
	0	0	**$0**
	0	0	**$0**
	0	0	**$0**
	0	0	**$0**
Totals	$11,534,205	$50,232	**$11,483,973**

*** If not reallocating E&G funds, please submit a zeroed Table 4**

APPENDIX B – CONSULTANTS' REPORT

Not Applicable

APPENDIX E – FACULTY VITA

Biographical Sketch – Jamel Ali, Ph.D.

Department of Chemical and Biomedical Engineering
FAMU-FSU College of Engineering
2525 Pottsdamer Street,
B373FTallahassee, FL32310

Telephone: (850) 410 6282
FAX: (850) 410 6150
E-mail:
jali@eng.famu.fsu.ed
u

a) Professional Preparation

Howard University	Washington, D.C.	Chemical Engineering	B.S.	2011
Howard University	Washington, D.C.	Chemical Engineering	M.S.	2013
Drexel University	Philadelphia, PA	Mechanical Engineering	Ph.D.	2016

b) Appointments

2018–present Assistant Professor, Chemical and Biomedical Engineering, Florida A&M University.
2017–2018 Chief Technology Officer, Acrogenic Technologies
2015–2016 National Defense Science and Engineering Graduate Fellow, Drexel University
2013–2014 Graduate Research Assistant, Mechanical Engineering, Drexel University
2011–2013 Graduate Research Assistant, Chemical Engineering, Howard University

c) Key Publications (5)

1. Rogowski, L. W., **Ali**, **J.**, Zhang, X., Wilking, J. N., Fu, H. C., & Kim, M. J. (2021). Symmetry Breaking Propulsion of Magnetic Microspheres in Nonlinearly Viscoelastic Fluids(Feature Article). Nature Communications, 12, 1116. doi:https://doi.org/10.1038/s41467- 021-21322-0
2. Benhal, P., Quashie, D., Jr., Cheang, U. K., & **Ali**, **J.** (2021). Propulsion Kinematics of Achiral Microswimmers in Viscous Fluids. Applied Physics Letters, 118, 204103. doi:https://doi.org/10.1063/5.0048277
3. **Ali**, **J.**, Kim, H., Cheang, U. K., & Kim, M. J. (2016). MicroPIV measurements of flows induced by rotating microparticles near a boundary. Microfluidics and Nanofluidics, 20, 131. doi:https://doi.org/10.1007/s10404-016-1794-2
4. **Ali**, **J.**, Cheang, U. K., Martindale, J. D., Jabbarzadeh, M., Fu, H. C., & Kim, M. J. (2017). Bacteria-inspired nanorobots with flagellar polymorphic transformations and bundling. Scientific Reports, 7, 14098. doi:https://doi.org/10.1038/s41598-017-14457-y
5. Tan, L., **Ali**, **J.**, Cheang, U. K., Shi, X., Kim, D., & Kim, M. J. (2019). µ-PIV Measurementsof Flows Generated by Photolithography-Fabricated Achiral Microswimmers. Micromachines, 10(12), 865. doi:https://doi.org/10.3390/mi10120865

Research Area Summary

As both a Chemical and Biomedical Engineer my research focuses on investigating and harnessing the unique physiochemical properties of stimuli-responsive nanobiomateirals for biological and environmental applications, including the development of rheologically tuned soft polymer materials, and active colloidal machines. I have a broad background in the fields of chemistry, biology, and biophysics with extensive laboratory experience in top-down and bottom-up micro and nano manufacturing and fluidics. As a HBCU faculty member, I also aim to broaden the participation of underrepresented groups and lead a diverse team that consist of undergraduate, graduate, and postdoctoral fellows. Through the unique FAMU-FSU College of Engineering partnership, and affiliation with and lab space in the National High Magnetic Field Laboratory, I have a number of ongoing collaborations spanning the physical sciences, environmental engineering, agriculture, food and nutrition sciences, robotics, and polymer engineering.

Biographical Sketch – Natalie Y. Arnett, Ph.D.

Department of Chemical and Biomedical Engineering
FAMU-FSU College of Engineering
2525 Pottsdamer Street,
Tallahassee, FL32310

Telephone: (850) 410 6294
FAX: (850) 410 6161
E-mail:
narnett@eng.famu.fsu.edu

a) Professional Preparation

Grambling State University	Grambling, LA	Chemistry	B.S.	2003
Virginia Tech	Blacksburg, VA	Macromol. Sci and Eng	Ph.D.	2013

b) Appointments

2019–present Associate Professor, Chemical and Biomedical Engineering, Florida A&M University.
2019–present Associate Professor, Chemistry, Florida A&M University.
2011–2019 Adjunct Associate Professor, Vanderbilt University
2009–2019 Chair of Life and Physical Sciences and Associate Professor, Fisk University
2004-2009 Graduate Research Assistant, Macromolecular Science and Engineering, Virginia Tech
2003–2004 Graduate Teaching Assistant, Chemistry Department, Virginia Tech

c) Key Publications (4)

1. T.N. Thompson and Natalie Arnett **"**Effect of phosphonated triazine monomer additive in disulfonated poly(arylene ether sulfone) composite membranes for proton exchange membrane fuel cells. *Polymer*, 171, 34-44 (2019)
2. Natalie Y. Arnett. PERSPECTIVES FROM THE FIELD: Building Research and Teaching Capacity of Early Career STEM Faculty at Historically Black Colleges and Universities (HBCUs), Jan 2016, (https://static1.squarespace.com/static/57b5ee7d440243ac78571d0a/t/57bb280cd2b8576c979439a1/1471883287643/QEM_PDM_Anthology_Reflections.pdf), 1-5.
3. Thompson, Tiffany N.; Ramos-Hunter, Susan; Robertson, Jasmine; Arnett, Natalie Y., "Interfacial synthesis of Bisphenol A Tetrachlorocyclotriphosphazene from Bisphenol A and Hexachlorocyclotriphosphazene." Tetrahedron Letters (2013), 54(39), 5311-5313.
4. Natalie Y. Arnett; William L. Harrison, Anand S. Badami, Abhishek Roy, Ozzie Lane, Frank Cromer, Limin Dong, and J.E. McGrath. "Hydrocarbon and partially fluorinated sulfonated copolymer blends as functional membranes for fuel cells." *J. Power Sources* 172 (2007) 20-29.

Research Area Summary

As an Associate Professor in both the Department of Chemistry at Florida A&M University (FAMU) and the Department of Chemical and Biomedical Engineering at the FAMU-FSU College of Engineering my research focuses on the development of multifunctional polymers for fuel cell, water purifications, drug delivery, and 3D printing. Considerable interest in designing new classes of polymers/composites with tailorable chemical/physical properties and enhanced performance will be evaluated. Special focus on the physical and chemical properties of poly(arylene ether)s and polyamide polymers and the contribution of the types/amounts of groups to the overall performance of the materials is being studied in my lab. Moreover, my aim is to also cultivate the next generation of underrepresented leaders and scholars by integrating research and academics, developing collaborations with internal and external departments, and providing students with interesting and relevant research opportunities.

Biographical Sketch - Tarik J. Dickens, Ph.D.

Department of Industrial and Manufacturing Engineering
FAMU-FSU College of Engineering
2525 Pottsdamer Street, B318
Tallahassee, FL32301-6604

Telephone: (850) 410 6353
FAX: (850) 410 6342
E-mail: dickens@eng.famu.fsu.edu

PROFESSIONAL PREPARATION

Institution, Location	*Major*	*Degree*	*Year*
Florida State University, Tallahassee, Florida	Industrial Engineering	B.Sc.	2005
Florida State University, Tallahassee, Florida	Industrial Engineering	M.Sc.	2007
Florida State University, Tallahassee, Florida	Industrial Engineering	Ph.D.	2013
No Post-Doctoral Experience			

APPOINTMENTS

- August 2013 – Present: *Assistant Professor, Industrial & Manufacturing Engineering, FAMU-FSU College of Engineering*
- 2009 - 2010: *Manufacturing Engineer, General Dynamics*
- 2008 - 2010: *Research Fellow Adelaide Wilson Doctoral Fellowship*
- 2005 - 2013: *Research Associate, High Performance Materials Institute*

SELECT PUBLICATIONS

1. Joshi, K., Pollard, M., Chiari, A., & Dickens, T., “Concrete-FRP Interfacial Bond Monitoring with Self-Triggering Sensors”, Journal of Intelligent Material Systems and Structures, (2018). doi.org/10.1177/1045389X18770859
2. Roy, M., Dickens, T. J., "Additive Technology of Soluble Mold Tooling for Embedded Devices in Composite Structures: A Study on Manufactured Tolerances" (2017). http://dx.doi.org/10.1016/j.addma.2017.03.012
3. Joshi, K., Mishra, S., Campbell, C., Vanli, A., and Dickens, T. “Light emitting composite beams on matrix cracking,” Journal of Composite Materials, Sage Publications, (2017). doi: 10.1177/0021998317701556
4. Frketic, J.; Dickens, T., “Automated Manufacturing and Processing of FRP Composites: An Additive Review of Contemporary and Modern Techniques for Advanced Materials Manufacturing,” Additive Manufacturing Journal. doi: 10.1016/j.addma.2017.01.003
5. K. Joshi, M. Scheiner, D. Olawale, and T. J. Dickens. 2016. Triboluminescent Sensors for Polymer-based Composites, in Triboluminescence - Theory, Synthesis, and Applications, D.O. Olawale, O.O.I. Okoli, R.S.Fontenot, W.A. Hollerman, Editors. Springer: New York, New York, United States of America.
6. M. Scheiner, T. J. Dickens, O. Okoli. “Progress towards Self-Healing Polymers for Composite Structural Applications.” Polymer. 83, 260-282, 2016.

Lewis Johnson

POSITION TITLE & INSTITUTION: Associate Provost for Student Success and Strategic Initiatives,

Florida A&M University

PROFESSIONAL PREPARATION

INSTITUTION	LOCATION	MAJOR / AREA OF STUDY	DEGREE (if applicable)	YEAR YYYY
North Carolina State University	Raleigh, NC	Physics	BS	1990
Duke University	Durham, NC	Physics	PHD	1997
Lawrence Berkeley National Laboratory	Berkeley, CA	Physics	Postdoctoral Fellow	1998 - 1999

APPOINTMENTS

2018 - present	Associate Provost for Student Success and Strategic Initiatives, Florida A&M University , Tallassee, FL
2012 - present	Professor of Physics, Florida A&M University, Tallahssee, FL
2017 - 2018	Assistant Vice President of Strategic Planning and Performance Metrics, FloridaA&M University, Tallahassee, FL
2012 - 2017	Assistant Dean, College of Science and Technology, Florida A&M University,Tallahassee, FL
2006 – 2012	Associate Professor of Physics, Florida A&M University, Tallahassee, FL
2000 – 2006	Assistant Professor of Physics, Florida A&M University, Tallahassee, FL
1998 - 1999	Staff Scientist, Center for X-Ray Optics / LBNL, Berkeley, CA

SELECTION OF PUBLICATIONS

1. Gutsev GL, Weatherford CA, Johnson LE, Jena P. Structure and properties of the aluminum borates Al(BO2)n and Al(BO2)n(-), (n = 1-4). J Comput Chem. 2012 Feb 5;33(4):416-24. PubMed PMID: 22121015.
2. Akpovo C, Ford A, Johnson L. Optimized LWIR enhancement of nanosecond and femtosecond LIBS uranium emission. Applied Physics B. 2016; 122(5):-. Available from: http://link.springer.com/10.1007/s00340-016-6427-7 DOI: 10.1007/s00340-016-6427-7
3. Akpovo C, Helms L, Profeta L, Johnson L. Multivariate determination of 10B isotopic ratio by laser-induced breakdown spectroscopy using multiple BO molecular emissions. Spectrochimica Acta Part B: Atomic Spectroscopy. 2019 December; 162:105710-. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0584854718305494 DOI: 10.1016/j.sab.2019.105710
4. Khalil A, Richardson M, Barnett C, Johnson L. Double pulse UV laser induced breakdown

spectroscopy of stainless steel. Journal of Applied Spectroscopy. 2006; 73(5):735-742. Available from: http://link.springer.com/10.1007/s10812-006-0147-4 DOI: 10.1007/s10812-006-0147-4

5. Gutsev G, Johnson L, Belay K, Weatherford C, Gutsev L, Ramachandran B. Structure and magnetic properties of Fe12X clusters. Chemical Physics. 2014 February; 430:62-68. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0301010413004643 DOI: 10.1016/j.chemphys.2013.12.014
6. Barnett C, Bell C, Vig K, Akpovo AC, Johnson L, Pillai S, Singh S. Development of a LIBS assay for the detection of Salmonella enterica serovar Typhimurium from food. Anal Bioanal Chem. 2011 Jul;400(10):3323-30. PubMed PMID: 21424774.
7. Brown S, Ford A, Akpovo C, Martinez J, Johnson L. Matrix effects in laser ablation molecular isotopic spectrometry. Spectrochimica Acta Part B: Atomic Spectroscopy. 2014 November; 101:204-212. Available from: https://linkinghub.elsevier.com/retrieve/pii/S058485471400233X DOI: 10.1016/j.sab.2014.09.003
8. Brown SR, Akpovo CA, Martinez J, Johnson L. Plasma dynamics in double-pulse LIBS on dicarboxylic acids using combined 532 nm Nd:YAG and carbon dioxide laser pulses. Appl Spectrosc. 2014;68(9):1046-59. PubMed PMID: 25226259.
9. Hacisalihoglu G, Stephens D, Johnson L, Edington M. The use of an active learning approach ina SCALE-UP learning space improves academic performance in undergraduate General Biology. PLOS ONE. 2018; 13(5):e0197916-. Available from: https://dx.plos.org/10.1371/journal.pone.0197916 DOI: 10.1371/journal.pone.0197916
10. Hacisalihoglu G, Stephens D, Stephens S, Johnson L, Edington M. Enhancing Undergraduate Student Success in STEM Fields through Growth-Mindset and Grit. Education Sciences. 2020 October 12; 10(10):279-. Available from: https://www.mdpi.com/2227-7102/10/10/279 DOI: 10.3390/educsci10100279

SYNERGISTIC ACTIVITIES

1. Have trained a total of 8 current and former African-American and Hispanic graduate students (MS/PhD Physics and or Environmental Science) and two postdocs - Ph.D. - Dr. Cleon Barnett (Ph.D. Physics 2007) (Alabama State University), Dr. Jorge Martinez (Ph.D. Physics 2013), Dr. Staci Brown (Ph.D. Physics 2015), Dr. Candace Harris (Ph.D. Physics 2018) M.S. - Mr. John Branch (M.S Environmental Science 2003), Mr. Vinay Jain (M.S Environmental Science 2007),Teresa Eaton (M.S Chemistry 2012) (Co-Advisor)
2. Developed a SCALE-UP (Active Learning) classroom and General Physics Course at FAMU. One of the first for an HBCU

Shyam Kattel, PhD
Assistant Professor
Department of Physics
Florida A&M University
Tallahassee, FL 32307
Jones Hall 209
E-mail: shyam.kattel@famu.edu
Phone: 850-599-8462

Research Interest

Computational design of materials for clean energy generation/fuel synthesis and energy storage: Electrocatalysis, Heterogeneous catalysis, Clean energy/fuel generation, Nanomaterials.
Approach: Density functional theory (DFT) electronic structure calculations; Kinetic Monte Carlo (KMC) simulations; Microkinetic modeling; Machine learning

Education and Research Trainings

Associate Research Scientist; July-Dec 2018
Columbia University, New York, NY

Research Associate; July 2014-June, 2018
Brookhaven National Laboratory (BNL), NY

Postdoctoral Research Associate; August 2012-June, 2014
University of Pittsburgh, Pittsburgh, PA

Ph. D. in Physics; 2012
New Mexico State University, Las Cruces, NM

Masters in Physics; 2005
Tribhuvan University, Kathmandu, Nepal

Bachelor Degree, Major in Physics & Chemistry; 2001
Mahendra Morang Campus, Biratnagar, Nepal

AWARDS

Dean's Award for Graduate Excellence 2012, College of Arts and Sciences, NMSU

Merit-Based Enhancement Fellowship Award 2011-2012, Graduate School, NMSU

Roberts Memorial Leadership Award 2011, Campus Activities, NMSU

Best Comprehensive Exam Award 2010, Department of Physics, NMSU

Publications

(*=corresponding author; ‡ = co-first author, google scholar citations: 4600+; h-index = 34)

1. R. Xia, D. Tian, **S. Kattel**, B. Hasa, H. Shin, X. Ma, J.G. Chen, F. Jiao, "Electrochemical reduction of acetonitrile to ethylamine", ***Nat. Commun***. 12, 1-8.
2. D. Ologunagba, **S. Kattel***, "Transition metal oxynitride catalysts for electrochemical reduction of nitrogen to ammonia", ***Mater. Adv***., 2021, 2, 1263-1270.

3. J.H. Lee, **S. Kattel***, Y. Wang, B.M. Tackett, Z. Xie, S. Hwang, S.R. Denny, W. Xu, J. G. Chen, "Prussian blue analogues as platform materials for understanding and developing oxygen evolution reaction electrocatalysts", ***J. Catal.*** 2021, 393, 390-398.
4. Q. Chang, J. Kim, J. H. Lee, **S. Kattel***, J. G. Chen, S. Choi, Z. Chen, "Boosting Activity and Selectivity of CO_2 Electroreduction by Pre-Hydridizing Pd Nanocubes", ***Small*****,** 2021, 16, 2005305.
5. Z. Xie, D. Tian, M. Xie, S.Z. Yang, Y. Xu, N. Rui, J.H. Lee, S.D. Senanayake, K. Li, H. Wang, **S. Kattel***, J.G. Chen "Interfacial Active Sites for CO_2 Assisted Selective Cleavage of C–C/C–H Bonds in Ethane", ***Chem***, 2020, 6, 2703-2716.
6. Z. Xie, Y. Xu, M. Xie, X. Chen, J.H. Lee, E. Stavitski, **S. Kattel***, J.G. Chen "Reactions of CO_2 and ethane enable CO bond insertion for production of C_3 oxygenates", ***Nat. Commun***. 2020, 11, 1-8
7. D. Ologunagba, **S. Kattel*** "Machine Learning Prediction of Surface Segregation Energies on Low Index Bimetallic Surfaces", ***Energies***, 2020, 13, 2182.
8. Q. He, J.H. Lee, D. Liu, Y. Liu, Z. Lin, Z. Xie, S. Hwang, S. **Kattel,*** L. Song,* and J.G. Chen "Accelerating CO_2 Electroreduction to CO Over Pd Single-Atom Catalyst", ***Adv. Funct. Mater***. 2020, 2000407.
9. B.B. Dangi, **S. Kattel,*** "Growth of carbonaceous material on silicon surface: Case study of 1,3-butadiene molecule", ***Chem. Phys. Lett***. 2020, 745, 137248.
10. Q. He, D. Liu, J. H. Lee, Y. Liu, Z. Xie, S. Hwang**, S. Kattel,*** L. Song,* and J. G. Chen, "Electrochemical Conversion of CO_2 to Syngas with Controllable CO/H_2 Ratios over Co and Ni Single-Atom Catalysts", ***Angew. Chem. Int. Ed.*** 2020, 59, 3033 –3037.
11. E. Gomez, B. Yan, **S. Kattel**, and J. G. Chen, " Carbon Dioxide Reduction in Tandem with Light Alkane Dehydrogenation" ***Nat. Rev. Chem***., 2019, *3*, 638–649.
12. J. H Lee, **S**. **Kattel‡**, Z. Jiang, Z. Xie, S. Yao, B. M. Tackett, W. Xu, N. S. Marinkovic, and J. G. Chen, "Tuning the Activity and Selectivity of Electroreduction of CO_2 to Synthesis Gas using Bimetallic Catalysts" ***Nat. Commun***, 2019, 10, 3724.
13. Q. Chang, **S. Kattel**, X. Li, Z. Liang, B. Tackett, S. Denny, P. Zhang, D. Su, J. G Chen, Z. Chen, "Enhancing CC Bond Scission for Efficient Ethanol Oxidation using PtIr Nanocube Electrocatalysts", ***ACS Catal.*** 2019, 9, 7618−7625.
14. X. Yang, **S. Kattel‡**, J. Nash, X. Chang, J. H. Lee, Y. Yan, J. G. Chen, B. Xu, "Quantification of Active Sites and Elucidation of Reaction Mechanism of Electrochemical Nitrogen Reduction Reaction on Vanadium Nitride", ***Angew. Chem. Int. Ed.*** 2019, 131, 13906–13910.
15. W. W. Luc, B. H. Ko, **S. Kattel**, S. Li, D. Su, J. G. Chen, F Jiao, "SO_2-induced Selectivity Change in CO_2 Electroreduction" ***J. Am. Chem. Soc.*** 2019, 141, 9902-9909.
16. B. Yan, B. Zhao, **S. Kattel**, Q. Wu, S. Yao, D. Su, J. G. Chen, "Tuning CO_2 hydrogenation selectivity via metal-oxide interfacial sites", ***J. Catal.*** 2019, 374, 60-71.

Before joining Florida A & M University

17. J. Wang, **S. Kattel**,‡ C.J. Hawxhurst, J.H. Lee, B.M. Tackett, K. Chang, N. Rui, C. J. Liu, J. G. Chen "Enhancing Activity and Reducing Cost for Electrochemical Reduction of CO_2 by Supporting Palladium on Metal Carbides", ***Angew. Chem. Int. Ed.*** 2019, 58, 6271-6275
18. Y. Wang, **S. Kattel**,‡ W. Gao, K. Li, P. Liu, J. G. Chen, H. Wang, "Exploring the ternary interactions in Cu–ZnO–ZrO_2 catalysts for efficient CO_2 hydrogenation to methanol", ***Nat. Commun.*** 2019, 10, 1166.
19. W. Zhu, **S. Kattel**,‡ F Jiao, J. G. Chen, "Shape-Controlled CO_2 Electrochemical Reduction on Nanosized Pd Hydride Cubes and Octahedra", ***Adv. Energy Mater***. 2019, 9, 1802840.
20. X. Yang, J. Nash, J. Anibal, M. Dunwell, **S. Kattel**, E. Stavitski, K. Attenkofer, J. G. Chen, Y. Yan, and B. Xu, "Mechanistic Insights into Electrochemical Nitrogen Reduction Reaction on Vanadium Nitride Nanoparticles", ***J. Am. Chem. Soc.*** 2018, 140,13387-13391 .
21. J. H. Lee, **S. Kattel**,‡ Z. Xie, B. M. Tackett, J. Wang, C. J. Liu, and J. G. Chen, "Understanding the Role of Functional Groups in Polymeric Binder for Electrochemical Carbon Dioxide Reduction on Gold Nanoparticles", ***Adv. Funct. Mater.*** 2018, 1804762.
22. K. A. Kuttiyiel, **S. Kattel**, S. Cheng, J. H. Lee, L. Wu, Y. Zhu, G. G. Park, P. Liu, K. Sasaki, J. G. Chen, and R. R. Adzic, "Au-Doped Stable L10 Structured Platinum Cobalt Ordered Intermetallic Nanoparticle Catalysts for Enhanced Electrocatalysis", ***ACS Appl. Energy Mater.*** 2018, 1, 3771−3777.
23. B. Yan, S. Yao, **S. Kattel**, Q. Wu, Z. Xie, E. Gomez, P. Liu, D. Su, and J. G. Chen, "Active sites for tandem reactions of CO_2 reduction and ethane dehydrogenation", ***Proc. Natl. Acad. Sci.*** 2018, 115, 8278-8283.
24. **S. Kattel**, J. G. Chen and P. Liu, "Mechanistic study of dry reforming of ethane by CO_2 on a bimetallic PtNi (111) model surface", ***Catal. Sci. & Technol***. 2018, 8, 3748–3758 (Back cover).
25. J. Wang, S. **Kattel**, Z. Wang, J. G Chen and C.J. Liu, "L-Phenylalanine Templated Platinum Catalyst with Enhanced Performance for Oxygen Reduction Reaction", ***ACS Appl. Mater. & Interfaces***, 2018, 10, 21321−21327.
26. Z. Xie, B. Yan, **S. Kattel**, J. H. Lee, S. Yao, Q. Wu, N. Rui, E. Gomez, Z. Liu, W. Xu, L. Zhang, and J. G. Chen, "Dry reforming of methane over CeO_2-supported Pt-Co catalysts with enhanced activity", ***Appl. Catal. B: Environ.*** 2018, 236, 280–293.
27. R. C. E. Hamlyn, M. Mahapatra, D. C. Grinter, F. Xu, S. Luo, R. M. Palomino, **S. Kattel**, I. Waluyo, P. Liu, D. J. Stacchiola, S. D. Senanayake and J. A. Rodriguez, "Imaging the ordering of a weakly adsorbed two-dimensional condensate: ambient-pressure microscopy and spectroscopy of CO_2 molecules on rutile TiO_2(110)", ***Phys. Chem. Chem. Phys.*** 2018, 20, 13122-13126.

28. E. Gomez, **S. Kattel**, B. Yan, S. Yao, P. Liu, and J. G. Chen, "Combining CO_2 reduction with propane oxidative dehydrogenation over bimetallic catalysts", ***Nat. Commun***, 2018, 9, 1398. (Highlighted in BNL: ChemistryViews, Phy.org)
29. L. Wang, S. Zhu, N. Marinkovic, **S. Kattel**, M. Shao, B. Yang, and J. G. Chen, "Insight into the synergistic effect between nickel and tungsten carbide for catalyzing urea electrooxidation in alkaline electrolyte", ***Appl. Catal. B: Environ.*** 2018, 232, 365–370.
30. X. Li, B. Yan, S. Yao, **S. Kattel**, J. G. Chen, and T. Wang, "Oxidative Dehydrogenation and Dry Reforming of n-Butane with CO_2 over NiFe Bimetallic Catalysts", ***Appl. Catal. B: Environ.*** 2018, 231, 213–223.
31. B. M. Tackett, W. Sheng, **S. Kattel**, S. Yao, B. Yan, K. A. Kuttiyiel, Q. Wu, and J. G. Chen, "Reducing Iridium Loading in Oxygen Evolution Reaction Electrocatalysts Using Core-Shell Particles with Nitride Cores", ***ACS Catal.*** 2018, 8, 2615-2621.
32. **S. Kattel***, P. Liu and J. G. Chen, "Tuning Selectivity of CO_2 Hydrogenation Reactions at the Metal/Oxide Interface", ***J. Am. Chem. Soc.*** 2017, 139, 9739-9754. (Highlighted in JACS spotlights)
33. **S. Kattel**, P. J. Ramírez, J. G. Chen, J. A. Rodriguez, and P. Liu, "Active Sites for CO_2 Hydrogenation to Methanol on Cu/ZnO Catalysts", ***Science*** 2017, 355, 1296-1299. (News coverage in BNL, ChemistryViews, Phy.org, Daily Mail, Chemical and Engineering News)
34. W. Sheng, **S. Kattel**, S. Yao, B. Yan, C. J. Hawxhurst, Q. Wu, and J. G. Chen, "Electrochemical Reduction of CO_2 to Synthesis Gas with Controlled CO/H_2 Ratios", ***Energy Environ. Sci***. 2017, 10, 1180-1185. (Back cover article)
35. X. Li, W. Wan, **S. Kattel**, J. G. Chen, and T. Wang, "Selective Hydrogenation of Biomass-Derived 2(5H)-Furanone over Pt-Ni and Pt-Co Bimetallic Catalysts: From Model Surfaces to Supported Catalysts", ***J. Catal.*** 2016, 344, 148-156.
36. B. Yan, X. Yang, J. Wan, M. Myint, **S. Kattel**, W. Xu, and J. G. Chen, "Dry Reforming of Ethane and Butane with CO_2 over PtNi/CeO_2 Bimetallic Catalysts", ***ACS Catal.*** 2016, 6, 7283-7292.
37. **S. Kattel**, B. Yan, Y. Yang, J. G. Chen, and P. Liu, "Optimizing Binding Energies of Key Intermediates for CO_2 Hydrogenation to Methanol over Oxide-Supported Copper", ***J. Am. Chem. Soc.*** 2016, 138, 12440-12450.
38. T. Nguyen-Phan, S. Luo, D. Vovchok, J. Llorca, S. Sallis, **S. Kattel**, W. Xu, L. F. J. Piper, D. E. Polyansky, S. D. Senanayake, D. J. Stacchiola, and J. A. Rodriguez, "Three-Dimensional Ruthenium-Doped TiO_2 Sea Urchins for Enhanced Visible-Light-Responsive H_2 Production", ***Phys. Chem. Chem. Phys.*** 2016, 18, 15972-15979.
39. **S. Kattel**, W. Yu, B. Yan, X. Yang, Y. Huang, W. Wan, P. Liu, and J. G. Chen, "CO_2 Hydrogenation over Oxide-Supported PtCo Catalysts: The Role of the Oxide Support in Determining the Product Selectivity", ***Angew. Chem. Int. Ed.*** 2016, 55, 7968-7973. (Selected as Hot Paper).

40. **S. Kattel**, B. Yan, J. G. Chen, and P. Liu, "CO_2 Hydrogenation on Pt, Pt/SiO_2 and Pt/TiO_2: Importance of Synergy between Pt and Oxide Support", ***J. Catal.*** 2016, 343, 115-126.

41. K. Liu, **S. Kattel**, V. Mao, and G. Wang, "Electrochemical and Computational Study of Oxygen Reduction Reaction on Non-Precious Transition Metal/Nitrogen Doped Carbon Nanofibers in Acid Medium", ***J. Phys. Chem. C*** 2016*,* 120, 1586-1596.

42. M. D. Porosoff, M. Myint, **S. Kattel**, Z. Xie, E. Gomez, P. Liu, and J. G. Chen, "Identifying Different Types of Catalysts for CO_2 Reduction by Ethane through Dry Reforming and Oxidative Dehydrogenation", ***Angew. Chem. Int. Ed.*** 2015, 54, 15501-15505.

43. X. Yang, **S. Kattel**, S. D. Senanayake, J. A. Boscoboinik, X. Nie, J. Graciani, J. A. Rodriguez, P. Liu, D. J. Stacchiola, and J. G Chen, "Low Pressure CO_2 Hydrogenation to Methanol over Gold Nanoparticles Activated on a CeO_x/TiO_2 Interface", ***J. Am. Chem. Soc.*** 2015, 137, 10104-10107.

44. X. Yang, **S. Kattel**, K. Xiong, K. Mudiyanselage, S. Rykov, S. D. Senanayake, J. A. Rodriguez, P. Liu, D. J. Stacchiola, and J. G. Chen, "Direct Epoxidation of Propylene over Stabilized Cu^+ Surface Sites on Titanium- Modified Cu_2O", ***Angew. Chem. Int. Ed.*** 2015, 54, 11946 -11951. (Frontispiece)

45. Y. Zhou, Q. Lu, Z. Zhuang, G. S. Hutchings, **S. Kattel**, Y. Yan, J. G. Chen, J. Q. Xiao, and F. Jiao, "Oxygen Reduction at Very Low Overpotential on Nanoporous Ag Catalysts", ***Adv. Energy Mater.*** 2015, 1500149.

46. M. D. Porosoff, **S. Kattel**, W. Li, P. Liu, and J. G. Chen, "Identifying Trends and Descriptors for Selective CO_2 Conversion to CO over Transition Metal Carbides", ***Chem. Commun.*** 2015, 51, 6988-6991.

47. W. Yuan, Y. Jiang, Y. Wang, **S. Kattel**, Z. Zhang, L.Y. Chou, C. K. Tsung, X. Wei, J. Li, X. Zhang, G. Wang, S. X. Mao, and Z. Zhang, "In Situ Observation of Facet-Dependent Oxidation of Graphene on Platinum in an Environmental TEM", ***Chem. Commun.*** 2015, 51, 350-353.

48. **S. Kattel**, and G. Wang, "Beneficial Compressive Strain for Oxygen Reduction Reaction on Pt(111) Surface", ***J. Chem. Phys.*** 2014, 141, 124713.

49. **S. Kattel**, P. Atanassov, and B. Kiefer, "A Density Functional Theory Study of Oxygen Reduction Reaction on Non-PGM Fe-N_x-C Electrocatalysts", ***Phys. Chem. Chem. Phys.*** 2014, 16, 13800-13806.

50. **S. Kattel**, P. Atanassov, and B. Kiefer, "Density functional Theory Study of the Oxygen Reduction Reaction Mechanism in a BN Co-Doped Graphene Electrocatalyst", ***J. Mater. Chem. A*** 2014, 2, 10273-10279.

51. **S. Kattel**, and G. Wang, "Reaction Pathway for Oxygen Reduction on FeN_4 Embedded Graphene", ***J. Phys. Chem. Lett.*** 2014, 5, 452-456.

52. **S. Kattel**, "Magnetic Properties of 3d Transition Metals (Sc, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, and Zn) and Nitrogen Functionalized Armchair Graphene Nanoribbon", ***RSC Adv.*** 2013, 3, 21110–21117.

53. **S. Kattel**, and G. Wang, "A Density Functional Theory Study of Oxygen Reduction Reaction on Me-N_4 (Me=Fe, Co, or Ni) Clusters between Graphitic Pores", ***J. Mater. Chem. A*** 2013, 1, 10790-10797.
54. **S. Kattel**, Z. Duan, and G. Wang, "Density Functional Theory Study of an Oxygen Reduction Reaction on a Pt_3Ti Alloy Electrocatalyst", ***J. Phys. Chem. C*** 2013, 117, 7107-7113.
55. **S. Kattel**, P. Atanassov, and B. Kiefer, "Catalytic Activity of Co-N_x/C Electrocatalysts for Oxygen Reduction Reaction: A Density Functional Theory Study", ***Phys. Chem. Chem. Phys*.** 2013, 15, 148-153.
56. **S. Kattel**, B. Kiefer, and P. Atanassov, "Density Functional Theory Study of Ni-N_x/C Electrocatalyst for Oxygen Reduction in Alkaline and Acidic Media", ***J. Phys. Chem. C*** 2012, 116, 17378-17383.
57. **S. Kattel**, P. Atanassov, and B. Kiefer, "Stability, Electronic and Magnetic Properties of In-plane Defects in Graphene: A First-Principles Study", ***J. Phys. Chem. C*** 2012, 116, 8161-8166.
58. T. S. Olson, S. Pylypenko, **S. Kattel**, P. Atanassov, and B. Kiefer, "Selectivity of Cobalt-based Non-platinum Oxygen Reduction Catalysts in the Presence of Methanol and Formic Acid", ***J. Phys. Chem. C*** 2010, 114, 15190-15195.

Selected Presentations

Invited: National Renewable Energy Laboratory (NREL), July 2019, Golden, CO

Contributed: Florida Section of ACS meeting, May 2019, Tampa, FL

Invited: ACS Spring Meeting, 2019, April, Orlando, FL

Before joining Florida A & M University

Invited: Department Seminar, August 2018, Florida A&M University, Tallahassee, FL

Invited: Department Seminar, April 2018, Department of Materials Science and Engineering, Southern University of Science and Technology, Shenzhen, China

Invited: Department Seminar, April 2018, Department of Chemical Engineering, Tsinghua University, Beijing, China

Invited: ACS Spring meeting 2018, New Orleans, LA

Invited: ACS Fall meeting 2017, Washington DC

Invited: International Conference on Catalysis and Chemical Engineering, 2017, Baltimore, MD

Invited: August 2016, NASA Ames Research Center, Mountain View, CA **(**Division Seminar)

Invited: Departmental seminar, Chemistry and Physical Sciences Department, March, 2016, Pace University, NY (Departmental Seminar)

Contributed: ACS Fall meeting, 2015, Boston, MA

Contributed: APS March Meeting, 2013, Baltimore, MD

Contributed: APS March Meeting, 2012, Boston, MA

Contributed: APS March Meeting, 2011, Dallas, TX

Contributed: 218th ECS Meeting, 2010, Las Vegas, NV

Contributed: APS March Meeting, 2010, Portland, OR

Professional Memberships

American Chemical Society

Synergistic Activities after joining Florida A & M University

Journal Reviewer: Nature Catalysis, ACS Catalysis, The Journal of Physical Chemistry C, The Journal of Physical Chemistry Letters, Energy & Environmental Science, Chemical Communications, Nanoscale, Journal of Materials Chemistry A, Physical Chemistry Chemical Physics, Applied Surface Science

Grants Reviewer: American Chemical Society Petroleum Research Fund

Session Chair/Organizer: Division of Catalysis Science and Technology, American Chemical Society National Meetings

Summer School: NSF-HBCU/MI Summer School: Computational Modeling of Disordered Materials, June 03-07, 2019, Long Beach, MS

Workshop: NSF-AAPT New Faculty Workshop, June-24-28, 2019, Baltimore, MD

Grants Awarded

1. Research Initial Award: A computational study of hydroformylation of ethylene over heterogeneous bimetallic catalysts, NSF-HBCU-UP-RIA, $298,542, 2020 Role **PI.**
2. Unraveling the Role of Catalytic Surfaces in Planetary Atmospheres, Florida Space Grant, $25,000, 2020, Role **Co-PI**.
3. Computational screening of materials for electrochemical carbon dioxide (CO_2) conversion, XSEDE, (TG-CHE200036): 12,900 Sus (12,900 × 68 = 877,200 CPU hours, duration: 05/31/2020- 6/30/202105/12/2020, Role **PI**.
4. Computational Study of Materials for Electrochemical Conversion of CO_2, National Energy Research Scientific Computing Center (NERSC) 100,000 CPU hours, duration: 01/08/2019-01/13/2020, Role **PI**.
5. Computational Study of Transition Metal Nitride based Catalysts for Hydrogen Evolution Reaction (HER) and Electrochemical Carbon Dioxide Reduction Reaction (CO_2RR), XSEDE-CHE190032: 108,800 CPU hours, duration: 05/13/2019-05/12/2020, Role **PI**.

Pending/Declined Grants Awards/Applications after joining FAMU

1. Study of Magneto-elastic Properties of Spinel Vanadates using Spectroscopic Techniques, NSF-DMR, $543,523, 2020, Role **Co-PI,** *declined.*

2. Center of Chemical Innovation Phase I: NSF Center for the Catalytic Conversion of Natural Gas Liquids (pre-proposal), NSF, 1,800,000, Role **Co-PI**, *not invited.*
3. Research Initial Award: A computational study of hydroformylation of ethylene over heterogeneous bimetallic catalysts, NSF-HBCU-UP-RIA, $298,542, 2020 Role **PI** (pending)
4. Tuning the Selectivity of Propane Oxidation to Acrylic Acid over MoVTeNbO based Mixed-Metal Oxide Catalysts: A Theoretical Study ACS-PRF, $110,000, 2020, Role **PI** (*declined*)
5. Laser – matter Interactions: Quantum Coherent Control of Break-up & Molecular Dissociation, DoD, 2019, $660,000, Role **Co-PI** (*declined*)

FAMU Students Mentored

1) Damilola Ologunagba (Ph. D. candidate, Physics: Fall 2019 - present)
2) Dorian Moore (MS Physics: Fall, 2020 - present)
3) Michael Lynn (undergraduate, Physics: Fall, 2020 - present)
4) Fayerachel Peterson (undergraduate, Chemistry: Fall 2020 - present)
5) Liana Vigoa (undergraduate, Physics: summer + Fall, 2019)
6) Elijah Athouris (undergraduate, applied physics: summer, 2019)

Biographical Sketch – Subramanian Ramakrishnan, Ph.D.

Department of Chemical and Biomedical Engineering
FAMU-FSU College of Engineering
2525 Pottsdamer Street, A131
Tallahassee, FL32310

Telephone: (850) 410 6159
FAX: (850) 410 6150
E-mail: srama@eng.fsu.edu

a) Professional Preparation

Indian Institute of Technology	Madras, India	Chemical Engineering	B.S.	1995
University of Illinois at Urbana-Champaign	Urbana, IL	Chemical Engineering	M.S.	1998
University of Illinois at Urbana-Champaign	Urbana, IL	Chemical Engineering	Ph.D.	2001
Princeton University	Princeton, NJ	Chemical Engineering		2001-2002
University of Illinois at Urbana-Champaign	Urbana, IL	Chemical Engineering		2002-2005

b) Appointments

2018–present Professor, Chemical and Biomedical Engineering, Florida A&M University.
2011–2018 Associate Professor, Chemical and Biomedical Engineering, Florida A&M University.
2005–2011 Assistant Professor, Chemical and Biomedical Engineering, Florida A&M University.
All appointments at Department of Chemical and Biomedical Engineering, FAMU-FSU College of Engineering

c) Key Publications (5)

1. Haney, R., Tran, P., Koerner, H., Trigg, E., Dickens, T., & Ramakrishnan, S. (2020). Printability and performance of 3D conductive graphite structures. Additive Manufacturing.
2. Shan, X., Mao, P., Li, H., Geske, T., Bahadur, D., Xin, Y., Ramakrishnan, S., & Yu, Z. (2019). 3D-Printed Photoactive Semiconducting Nanowire–Polymer Composites for Light Sensors. ACS Applied Nano Materials.
3. Mondal, A., Gebeyehu, A., Mariza, M., Bahadur, D., Ramakrishnan, S., Rishi, A., & Singh, M. (2019). Characterization and Printability of Sodium Alginate-Gelatin Hydrogel for Bioprinting NSCLC co-culture. Scientific Reports (Nature), 9:19914, 1-9.
4. Bahadur, D., Zhang, Q., Dufresne, E., Grybos, P., Kmon, P., Leheny, R., Maj, P., Narayanan, S., Szczygiel, R., Swan, J., Sandy, A., & Ramakrishnan, S. (2019). Evolution of structure and dynamics of thermo-reversible nanoparticle gels—A combined XPCS and rheology study. Journal of Chemical Physics, 151, 104902(1-17).
5. Vakil, P. N., Muhammed, F., Hardy, D., Dickens, T. J., Ramakrishnan, S., & Strouse, G. F. (2018). Dielectric Properties for Nanocomposites Comparing Commercial and Synthetic Ni and Fe3O4 Loaded Polystyrene. ACS Omega, 3, 12813-12823.

Research Area Summary: Research in my group focuses on understanding the physics, chemistry and processing of complex fluids (colloids, proteins, polymers and other "soft materials") with an aim of producing useful materials for engineering applications. In the process, we will also address fundamental questions that arise in assembling them into useful structures. My current research group consists of 1 post-doctoral associate and 4 PhD students. My work has led to a **funded sabbatical (by NSF) at Harvard University** and 3 summer faculty fellowships at AFRL. I am currently the director of the NSF funded CREST Center on additive manufacturing at FAMU – the CREST center currently has 11 domestic African American Students. I was awarded a 3M Distinguished Professorhip at FAMU beginning Jan 2021.

Keerthi Senevirathne **Curriculum Vitae**

Department of Chemistry
Florida A&M University
1530, S. Martin Luther King Jr. Blvd.
Tallahassee, FL 32307
EMAIL: keerthi.senevirathne@famu.edu
TEL: 850-599-3089

1324, Conservancy Dr. East
Tallahassee, FL 32312
Senevirathne.k@gmail.com
(850)-631-6319 (mobile)
(336)-757-8417 (home)

EDUCATION

Ph. D., Inorganic Materials Chemistry August 2008
Dept. of Chemistry, Wayne State University, Detroit, MI, USA
Advisor: Prof. Stephanie L. Brock
Dissertation: Synthesis, characterization, and assembly of metal pnictide nanoparticles, and evaluation of their physicochemical (catalytic, magnetic, and semiconductor) properties

Bachelor of Science (1st Class Honors), Chemistry January 2001
University of Kelaniya, Sri Lanka

POSITIONS HELD

- Associate professor, Department of Chemistry, Florida A&M University 2019-current
  Tallahassee, FL 32307
- Assistant professor, Department of Chemistry, Florida A&M University
  Tallahassee, FL 32307 2014-2019
- Postdoctoral Research Associate, Center for Energy, Environment and Sustainability
  Wake Forest University, Winston-Salem, NC 27109. 2011- 2014
- Adjunct Instructor, Forsyth Tech Community College,
  Winston-Salem, NC 27106 2013- 2014
- Research Associate, Institute for Fuel Cell Innovation-National Research Council
  Canada Vancouver, BC, V6T 1W5, Canada 2009 - 2011
- Graduate Teaching/Research Assistant, Department of Chemistry, Wayne State University,
  Detroit, MI 48202, USA 2003 - 2008
- Graduate Teaching, Department of Chemistry, University of Iowa
  Iowa City, IA, 52242, USA 2002 - 2003
- Assistant Lecturer, Department of Chemistry University of Kelaniya, Dalugama, Kelaniya,
  Sri Lanka 2001- 2002

RESEARCH & TEACHING EXPERIENCE

Assistant professor, Florida A&M University, Tallahassee, FL 32307 2014-current

Teaching experience:

- Taught CHM 1020 (Fundamentals of Chemistry), CHM 1045 (General Chemistry 1), CHM 3610 (Intermediate Inorganic Chemistry), CHM 5610 (Advanced Inorganic Chemistry), and CHM 1045 laboratory

Research:

- Metal oxide nanofibers; synthesis, characterization, and property evaluation in light of photocatalysis
- Inorganic materials for biodiesel production
- Anisotropic metal oxide nanomaterials synthesis and characterization

Research Associate, Wake Forest University Winston-Salem, NC 27106 2011- 2014

Research Experience:

(1) Use of low temperature and sol-gel synthetic routes to prepare $Zn_xGa_{1-x}O_xN_{1-x}$, MCM/$NaTO_3$ composites, and $In_{1-x}M_xTaO_4$ (M = Ni, Cr, Tb) photocatalysts for the generation of hydrogen and oxygen through stoichiometric water splitting and pollution remediation. Modification of synthesis conditions to make different shapes including rods, ovals, and spheres. Characterization of products by X-ray powder diffraction, transmission and scanning electron microscopies, energy dispersive spectroscopy, thermal gravimetric analysis, BET surface area analysis, diffuse reflectance spectroscopy and photocatalytic testing and product evaluation by gas chromatography.

(2) Use of solid state synthesis methods to make lithium-phosphorous-oxynitride (Li_2PO_2N) as a solid electrolyte for Li^+ ion battery application. Complete characterization by wide range of physical methods including ionic conductivity.

Teaching Experience:

- Designed and taught topics on "Introduction to nanomaterials and nanomaterials synthesis as a part of the Solid State Chemistry course CHM 366 A at the Department of Chemistry, Wake Forest University
- Developed undergraduate curriculum for environmental chemistry laboratory class CHM 120
- Mentored and trained one graduate and two undergraduate students

Trey Coury - undergraduate student, Wake Forest University, worked on synthesis of high surface area doped metal oxides

Zack Hood - undergraduate student, Wake Forest University, work on solid electrolyte materials for Li-ion batteries

Shiba Adikari - graduate student, Wake Forest University, worked on synthesis and characterization of Li_2SiO_3-Li_2PO_2N solid solutions as solid electrolyte for Li-ion batteries

Adjunct Instructor, Forsyth Technical Community College, Winston Salem, NC 27106 2013-current

(1) Taught CHM 151; General Chemistry 1 in-class lecture and laboratory classes
(2) Experienced with online teaching using Blackboard learning system. Conducted online teaching of CHM 151 General Chemistry course
(3) Utilized Blackboard learning system for communication, testing, grading, and evaluating students
(4) Participated in student recruitment and registration duties

Research Associate, NRC-Institute for Fuel Cell Innovation, Vancouver, BC, V6T 1W5 Canada **2009 - 2011**

(1) Fully involved in an applied materials project focused on developing non-carbon proton exchange membrane (PEM) fuel cell catalysts in collaboration with Ballard and Automotive Fuel Cell Cooperation (located in greater Vancouver area) as industry partners.

(2) Use of electrospinning techniques to fabricate high surface area metal-doped niobium and titanium oxide nanofibers as supports for PEM fuel cells.

(3) Use of Ultrasonic Spray Pyrolysis (USP) techniques to synthesize ceramic nanospheres of metal-doped TiO_2 (Metal=Ir, Ru, In, and Nb) and metal oxide/carbon composites as PEM fuel cell supports.
(4) Evaluation of physicochemical properties including bulk electronic conductivity, thermal and chemical durability of ceramic oxide nanomaterials.

Research Assistant - Dept. of Chemistry, Wayne State University, Detroit, MI 2003 – 2008

Research Experience:
(1) Synthesized discrete nickel phosphide (Ni_2P) nanoparticles as a hydrotreating catalyst for oil upgrading by a surfactant-assisted solution phase method and evaluated ligand-exchange/ ligand removal processes. Correlated hydrodesulfurization (HDS) activity towards a model feed of thiophene with surface area, surface functionalization, and structural transformations of Ni_2P nanoparticles and aerogels.

(2) Developed a solution-phase synthesis method of discrete manganese arsenide (MnAs) nanoparticles; evaluated their magnetic properties as a function of size and phase.

(3) Demonstrated the oxidative assembly of thiolate-capped Ni_2P, InP, and MnP into highly porous nanostructures (aerogels).

Teaching Experience **(Received certificate for excellence in teaching**):
- Teaching assistant (2003-2005) – conducted general, organic, and analytical chemistry laboratory and quiz classes, proctored and graded exams.
- Used Black board online learning management system to organize content, communicate with students, and record grades.

Assistant Lecturer – University of Kelaniya, Sri Lanka **2001- 2002**

- Design & taught (1) advanced coordination chemistry (2) symmetry and group theory (3) nuclear chemistry lecture courses for Junior (third year) undergraduate students
- Prepared and conducted organic and inorganic chemistry laboratory classes
- Supervised teaching assistants, proctored, and graded exams

TECHNICAL SKILLS

- Skilled in characterization of nanoparticles, nanofibers, aerogels by XRD, TEM & SEM, EDS, TGA, FTIR, BET surface area analysis, AAS, UV-Vis, and photoluminescence spectroscopy.

- Expertise in synthesis and handling of air and moisture sensitive materials using inert atmosphere glove box and Schlenk line techniques.

- Experienced with photocatalytic gas analysis measurements using gas chromatography (GC).

- Highly experienced in fabrication of high surface area metal oxide nanofibers by electrospinning and microspheres by ultrasonic spray pyrolysis (USP) techniques.
- Expertise in electrochemical measurements (CV) and evaluation of electrochemical surface area, mass activities, and specific activities of Pt and Pt-metal alloy based electrocatalysts supported on metal oxide nanofibers and nanoparticles.

- Experienced with supercritical fluid extraction for synthesis of high surface area mesoporous aerogels of catalytic, semiconductor, and magnetic microstructures.

- Mastery in handling high temperature reducing atmosphere furnaces.

- Ability to construct and maintain ultrasonic spray pyrolysis and electrospinner set-ups.

- Experienced at writing journal papers, technical reports, and standard operating procedures (SOP).

PUBLICATIONS AND PATENTS

1. **Senevirathne, K.;** Pitigala S.; Ramaraj, S.; Lachgar, A.; Williams, R. "Solution-phase Synthesis of Zn-doped GaN Photocatalysts: Morphology, Composition, and Catalytic Activity towards Methylene Blue Degradation and 4-nitroaniline Conversion, *A. J. Nano Mater*. **2017**, 5, 43-50
2. **Senevirathne, K.;** Lachgar, A.; Williams, R. "MCM/$NaTaO_3$ composite catalysts for organic molecule conversion: A case of *p*-nitroaniline conversion" *Journal of Physics : Conference series,* **2016,** 758, 012003, 1-14

3. Li, D.; **Senevirathne, K**.; Aquilina, L.; Brock, S. "Effect of synthetic levers on nickel phosphide nanoparticle formation: Ni_5P_4 and NiP_2", submitted to Journal of Inorganic Chemistry, 2015

4. Hitihami-Mudiyanselage, A.; **Senevirathne, K**.; Brock, S. L. "Bottom-Up Assembly of Ni2P Nanoparticles into Three-Dimensional Architectures: An Alternative Mechanism for Phosphide Gelation" Chem. Mater. **2014**, 26, 6251-6256
5. Hitihami-Mudiyanselage, A.; **Senevirathne, K**.; Brock, S. L. "Assembly of Phosphide nanocrystals into Porous Networks: Formation of InP Gels and Aerogels" *ACS Nano,* **2013**, 7, 1163-1170
6. **Senevirathne, K**.; Day, C. S.; Gross, M.; Lachgar, A.; Holzwarth, N. "A new crystalline LiPON electrolyte: Synthesis, Properties, and Electronic Structure" *Solid State Ionics*, **2013**, 233, 95**-**101
7. **Senevirathne, K.;** Neburchilov, V.; Alzate, V.; Baker, R.; Neagu, R.; Zhang, J.; Campbell, S.; Ye, S. "Nb-doped TiO_2/carbon composite supports synthesized by ultrasonic spray pyrolysis for proton exchange membrane (PEM) fuel cell catalysts" *J. Power Sources*, **2012**, 220, 1-9.
8. **Senevirathne, K**.; Hui, R.; Campbell, S.; Ye, S.; Zhang, J. " Electrocatalytic activity and durability of Pt/NbO_2 and Pt/Ti_4O_7 nanofibers for PEM fuel cell oxygen reduction reaction" *Electrochimica Acta*, **2012**, 59, 538-547.
9. Neburchilov, V.; Wang, Y.; **Senevirathne, K**.; Wilkinson, D.; Zhang, J.; Hybrid catalyst supports and supported catalysts for fuel cells and metal-air batteries (**U.S Provisional patent Application # 61/601173, 2012)**.
10. Tian, P.; Zhang, Y.; **Senevirathne, K.;** Brock, S.; Dixit, A.; Lawes, A.; Billinge, S. "Diverse structural and magnetic properties of differently prepared MnAS nanoparticles" *ACS Nano*, **2011**, 5, 2970-2978.
11. Wei, H.; Cleary, Z.; Song, P.; **Senevirathne, K.;** Eilers, H. "Fluorescence lifetime modification in Eu:Lu_2O_3 nanoparticles in the presence of silver nanoparticles" *J. Alloys Comp*. **2010**, 500, 96-101.
12. **Senevirathne, K.;** Tackett, R.; Kharel, P. R.; Lawes, G.; Somaskandan, K.; Brock, S. L. "Discrete, dispersible MnAs nanocrystals from solution method: phase control on the nanoscale and magnetic consequences" *ACS Nano* **2009**, 3, 1129-1138.
13. Brock, S. L.; **Senevirathne, K.** " Recent developments in synthetic approaches to transition metal phosphide nanoparticles for magnetic and catalytic applications" *J. Solid State Chem*. **2008**, 181, 1552-1559.
14. **Senevirathne, K.;** Burns, A.; Bussell, M. E.; Brock, S. L. "Synthesis and characterization of discrete nickel phosphide (Ni_2P) nanoparticles: effect of surface ligation chemistry on catalytic hydrodesulfurization of thiophene" *Adv. Funct. Mater.* **2007,** 17, 3933-3939**.**
15. **Senevirathne, K.;** Lachgar, A.; Williams, R. "Anisotropic Metal Oxynitride Photocatalysts for Methylene Blue Degradation: Shape Dependent Catalytic Properties" *in preparation*
16. **Senevirathne, K.;** Lachgar, A.; Williams, R. "MCM/$NaTaO_3$ composite catalysts for organic molecule conversion: A case of *p*-nitroaniline conversion" *in preparation*

CONFERENCE PRESENTATIONS AND WORKSHOPS

- **Senevirathne, K**.; Lachgar, A.; Williams, R. "$NaTaO_3$/MCM-48 composite catalysts for photocatalytic organic molecule conversion" ACS South Eastern Regional Meeting 2013, Atlanta, GA

- **Senevirathne, K**.; Williams, R.; Lachgar, A "Anisotropic Metal Oxynitride Photocatalysts for Water Splitting: Shape Dependent Catalytic Properties". ACS South Eastern Regional Meeting 2012, Raleigh, NC.
- Annual Workshop on Electrochemical Measurements: Theory and Hands on Experience, 2012, Case Western Reserve University, Cleveland, OH.
- **Senevirathne, K**.; Hui, R.; Campbell, S.; Ye, S.; Guest, A.; Zhang, J. "Synthesis and Characterization of Pt/NbO_2 Nanofibers and their Electrocatalytic Activities toward the Oxygen Reduction Reaction" Hydrogen + Fuel Cells 2011: International Conference and Exhibition, 2011, Vancouver, BC, Canada.
- **Senevirathne, K**.; Burns, A.; Bussell, M. E.; Brock, S. L "Synthesis and Characterization of Dinickel Phosphide (Ni_2P): HDS Activity Evaluation of Nanoparticles and Aerogels", 233rd American Chemical Society National Meeting, 2007, Chicago, IL.
- **Senevirathne, K**.; Burns, A.; Bussell, M. E.; Brock, S. L Advanced Workshop on Recent Developments in Nanomaterials, "Synthesis, Characterization and HDS Activity of Nickel Phosphide Nanoparticles and Aerogels", The Abdus Salam International Center for Theoretical Physics (ICTP), 2007, Trieste, Italy.
- **Senevirathne, K**.; Burns, A.; Bussell, M. E.; Brock, S. L. "Synthesis and Characterization of Nickel Phosphide: Nanoparticles to Aerogels", 8th Annual Chemistry Graduate Student Research Symposium, Wayne State University, 2006, Detroit, MI.
- **Senevirathne, K**.; Brock, S. L "Synthesis and Characterization of Discrete Nanoparticles of Ni_2P", Midwest Solid State Conference (MWSSC), University of Notre Dame, 2005, South Bend, IN.

AWARDS AND FELLOWSHIPS

- Certificate of award for excellence in undergraduate teaching services, Department of Chemistry, Wayne State University, 2007
- Graduate Research Fellowship, Institute for Manufacturing Research (IMR), Wayne State University, 2006-2007
- Award for the best oral presentation, WSU Graduate Research Symposium, 2006
- Poster presentation award, WSU Graduate Research Symposium, 2005

PROFESSIONAL AFFILIATIONS

- Member of the American Chemical Society (ACS) 2006 - current
- Member of the Electrochemical Society 2009 - 2011
- Member of the Materials Research Society 2010 - current
- Member of Phi Lambda Upsilon 2005 - current

SERVICE IN THE PEER REVIEW PROCESS

- *Nano*, *International Journal of Inorganic Chemistry*, *Radiation Measurements, and Elsevier Chemical Engineering Journal*

Dr. Komalavalli Thirunavukkuarasu

Assistant Professor
Department of Physics
Florida A&M University
111 Jones Hall
Tallahassee, FL 32307
Phone: (+1) 850 599 3925 (Office)
(+1) 850 591 6446 (Mobile)
Email : komalavalli.thirunav@famu.edu
komalavalli@magnet.fsu.edu

Education and Work Experience

Jan. 2016 – current	Assistant Professor Department of Physics Florida A&M University Tallahassee, FL, USA. Affiliate appointments: Department of Chemical and Biomedical Engineering FAMU-FSU College of Engineering Tallahassee, FL, USA National High Magnetic Field Laboratory (MagLab), Tallahassee, FL, USA.
Feb. 2015 – Dec. 2015	Visiting Associate-in-Research, MagLab, Tallahassee, FL, USA.
May 2014 – Jan. 2015	Postdoctoral research associate, MagLab, Tallahassee, FL, USA.
May 2012- May 2014	Postdoctoral research associate via Feodor-Lynen fellowship MagLab, Tallahassee, FL, USA.
Aug. 2009 – Apr. 2012	Postdoctoral scientist, II. Physikalisches Institut, Universität zu Köln, Germany.
Nov. 2004 – Jul. 2009	Ph.D. in Physics, Experimentalphysik II, Universität Augsburg, Germany.
Aug. 2003 – Nov. 2004	Master's degree in Physics, Universität Stuttgart, Stuttgart, Germany. Technical assistant, 1. Physikalisches Institut, Universität Stuttgart, Germany.

Aug. 2001 – Jun. 2003	Master's degree in Physics, Indian Institute of Technology Madras, Chennai, India.
Oct. 1999 – Jul. 2001	Technical Editor, Domex Technical Information, Chennai, India. Involved in abstracting and editing technical patents.
Jun. 1999 – Sep. 1999	Marketing management Trainee, Direct Marketing MNC, Chennai, India.
Jul. 1996 – May 1999	Bachelor's degree (vocational) in Physics, University of Madras, Chennai, India.
Jun. 1982 – May 1996	Schooling via Central Board of Secondary Education, India.

Fellowships and Grants

- 2012-2014: Feodor-Lynen Fellowship from Alexander von Humboldt Foundation, Germany.
- 2016-2019: Office of Naval Research HBCU/MI program (PI, Award: $375,000).
- 2017-2019: DoD Equipment Grant for HBCU/MI program (PI, Award: $336,000).
- 2019-2020: FSU Council on Research and Creativity (CRC) (Co-PI, Award: $63,000).
- 2019-2020: DoD Equipment Grant for HBCU/MI program (Co-PI, Award: $435,000)
- 2019-2021: User Collaboration Grant Program at NHMFL (PI, Award: $218,000).
- 2021-2023: DoD Equipment Grant for HBCU/MI program (co-PI, Award: $207,323)

Technical Skills

- Fourier-transform infrared spectroscopy (also in synchrotron radiation facility)
- Raman scattering and Photoluminescence
- High frequency electron paramagnetic resonance/electron spin resonance
- Broadband cw THz spectroscopy based on photomixing of lasers
- Handling of high magnetic fields
- High-pressure techniques (DACs, cryogenic pressure medium loading, etc.)
- Low-temperature techniques (Handling cryogenic liquids, usage of Helium-flow cold finger as well as bath cryostats)
- Resonant inelastic X-ray scattering measurements (limited experience at PSI Villigen)
- SQUID magnetometry

Academic Service

Note: Only the most significant activities are listed here

- Department of Physics Assessment Coordinator Since Fall 2017
- Florida A&M University Faculty Senate (Aug. 2016-Aug. 2018)
- Florida A&M University Strategic planning subcommittee for high impact research and commercialization (2017)
- Organizer/Participant for STEM Day, Florida A&M University
- Reviewer for international scientific journals such as American Physical Society, Modern Physics Letters, Bulletin of Materials Science, Optics Letters, Inorganic Chemistry.
- Representative for MagLab at the office of postdoctoral affairs, FSU (2013-2015)
- Diversity Committee member at MagLab (2014 and 2015, 2019-Present)
- Coordinator for postdoctoral seminar series at MagLab (2013-2015)
- Organizing team of FSU postdoc symposium 2013 and 2014
- MagLab search committees for scientists and engineers.
- Panelist in STEM careers discussion at Oasis Center for Women, Tallahassee, USA, Tallahassee Science Festival (2018).
- Regular Tour Guide (both public as well as students/scientists) – More than 10 Tours in the last 5 years and Open House Day Volunteer at MagLab.
- Speaker at Maclay School Career Day, Fall 2019
- Science Fair Judge at Griffin Middle School, Fall 2019
- NSF Reviewer Panelist for GRFP 2020 applications.
- Faculty Search Committee member in College of Science and Technology (2018, 2019).
- Panel Moderator in International EWFN Summit 2019, Tallahassee, USA.
- Science day at Pineview Elementary School in December 2019.

Teaching Experience

PERIOD	COURSE	LEVEL	DESCRIPTION
Spring Semester 2021	General Physics II & College Physics II Lab	Undergraduate	Fundamental concepts in physics based on calculus as perquisite. Laboratory course on electricity, magnetism and optics for algebra-based introductory physics course.
Fall Semester 2020	College Physics II & College Physics I Lab	Undergraduate	Fundamental concepts in physics based on algebraic mathematics
Spring Semester 2020	Condensed Matter Physics & Physics Seminar II	Undergraduate	Fundamental concepts in condensed matter physics that includes crystal structure, electronic properties, band structure, magnetism and superconductivity. The seminar consists of presentations on various physics topics from students as well as researchers.
Aug. 2018-Dec. 2019	General Physics I & II	Undergraduate	Fundamental concepts in physics explained with calculus as prerequisite
Aug. 2017-Apr. 2018	Condensed Matter Physics I & II	Graduate	Fundamental concepts in condensed matter physics that includes crystal structure, electronic properties, band structure, magnetism and superconductivity
Jan. 2016-Aug. 2017	1. General Physics Laboratory 2. College Physics Laboratory 3. College Physics I & II Lecture	Undergraduate	Fundamental concepts in physics explained with and without calculus as prerequisite
2012-2015	Run lab practicals on optical spectroscopy	Undergraduate/ Graduate	Preparing class materials and conducting lab practicals for undergraduate and graduate level students
Winter Semester 2011/12	Condensed Matter Physics I	Master (Physics)	In-charge of assignments, solution and conducting tutorial classes for the lecture of PD Dr. T. Lorenz at Institute of Physics II, University of Cologne
Summer Semester 2011	"ExperimentalPhy-sik: Struktur der Materie Teil 3 - Festkörperphysik"	Physics teachers course "Studierende des Lehramts Physik"	Responsible for preparing and supervising assignments, solutions, exam problem sheets for the lecture of PD Dr. J. Hemberger at Institute of Physics II, University of Cologne
Winter Semester 2010/11	Condensed Matter Physics I	Master (Physics)	In-charge of assignments and tutorial classes for the lecture of Prof. Dr. M. Grüninger at Institute of Physics II,

			University of Cologne
Summer Semester 2010	Solid State Physics	Bachelor (Physics)	Responsible for preparing and supervising assignments, solutions, exam problem sheets for the lecture of PD Dr. J. Hemberger at Institute of Physics II, University of Cologne
Winter Semester 2009/10	Solid State Physics II	Master (Physics)	Responsible for assignments, solution and conducting tutorial classes for the lecture of Prof. Dr. M. Grüninger at Institute of Physics II, University of Cologne
Summer Semester 2009	"Material-wissenschaften II"	Bachelor (Materials Science)	Preparation of problem sheets and solutions for Materials Science II course offered by Prof. Dr. C. Kuntscher at Chair of Experimental Physics II, University of Augsburg
Oct. 2006 – Jul. 2007	Laboratory course: Infrared spectroscopy	Bachelor (Physics/ Materials Science)	Responsibility of preparing course materials, conducting the experimental course and evaluation of students; Offered in the Chair of Experimental Physics II by Prof. Dr. C. Kuntscher, University of Augsburg

Publications List

1. Applying Unconventional Spectroscopies to the Single-Molecule Magnets, Co(PPh3)2X2 (X = Cl, Br, I): Unveiling Magnetic Transitions and Spin-Phonon Coupling, A. N. Bone, C.N. Widener, D.H. Moseley, Z. Liu, Z. Lu, Y. Cheng, L.L. Daemen, M. Ozerov, J. Telser, K. Thirunavukkuarasu, D. Smirnov, S.M. Greer, S. Hill, J. Krzystek, K. Holldack, A. Aliabadi, A. Schnegg, K.R. Dunbar, and Z. Xue, Chemistry - A European Journal **27**, 1 (2021).

2. The Future of the Correlated Electron Problem, A. Alexandradinata, N.P. Armitage, Andrey Baydin, Wenli Bi, Yue Cao, Hitesh J. Changlani, Eli Chertkov, Eduardo H. da Silva Neto, Luca Delacretaz, Ismail El Baggari, G.M. Ferguson, William J. Gannon, Sayed Ali Akbar Ghorashi, Berit H. Goodge, Olga Goulko, G. Grissonnanche, Alannah Hallas, Ian M. Hayes, Yu He, Edwin W. Huang, Anshul Kogar, Divine Kumah, Jong Yeon Lee, A. Legros, Fahad Mahmood, Yulia Maximenko, Nick Pellatz, Hryhoriy Polshyn, Tarapada Sarkar, Allen Scheie, Kyle L. Seyler, Zhenzhong Shi, Brian Skinner, Lucia Steinke, K. Thirunavukkuarasu, Thaís Victa Trevisan, Michael Vogl, Pavel A. Volkov, Yao Wang, Yishu Wang, Di Wei, Kaya Wei, Shuolong Yang, Xian Zhang, Ya-Hui Zhang, Liuyan Zhao, Alfred Zong, submitted to Nature Quantum Materials, arXiv:2010.00584 (2021).

3. Magneto-elastic coupling in multiferroic metal-organic framework $[(CH_3)_2NH_2]Co(HCOO)_3$, K. Thirunavukkuarasu, R, Richardson, Z. Lu, D. Smirnov, N. Huang, N. Combs, G. Pokharel, and D. Mandrus, AIP Advances **11**, 015040 (2021).

4. Magnetoelastic distortion of multiferroic BiFeO3 in the canted antiferromagnetic state, T. Rõõm, J. Viirok, L. Peedu, U. Nagel, D. G. Farkas, D. Szaller, V. Kocsis, S. Bordács, I. Kézsmárki, D. L. Kamenskyi, H. Engelkamp, M. Ozerov, D. Smirnov, J. Krzystek, K. Thirunavukkuarasu, Y. Ozaki, Y. Tomioka, T. Ito, T. Datta, and R. S. Fishman, Phys. Rev. B **102**, 214410 (2020).

5. Magnetic Properties and Electronic Structure of the S = 2 Complex $[Mn^{III}\{(OPPh_2)_2N\}_3]$ Showing Field-Induced Slow Magnetization Relaxation, Y. Sanakis, J. Krzystek, D. Maganas, A. Grigoropoulos, E. Ferentinos, M. Kostakis, V. Petroulea, M. Pissas, K. Thirunavukkuarasu, W. Wernsdorfer, F. Neese, P. Kyritsis Inorg. Chem. **59**, 13281 (2020).

6. Magnetostructural and EPR Studies of Anisotropic Vanadium trans- Dicyanide Molecules, M. Saber, K. Thirunavukkuarasu, S. Greer, S. Hill, K. Dunbar, Inorg. Chem. **59**, 13262 (2020).

7. Direct observation of magnetic transitions in a nickel (II) Complex with large anisotropy, C. Widener, A. Bone, M. Ozerov, R. Richardson, Z. Lu, K. Thirunavukkuarasu, D. Smirnov, X. Chen, Z. Xue, Chinese J. Inorg. Chem. **36**, 1149 (2020).

8. Inter-Kramers Transitions and Spin-Phonon Coupling in a Lanthanide-Based Single-Molecule Magnet, D. Moseley, S. Stavretis, C. Brown, M. Ozerov, D. Smirnov, Y. Cheng, L. Daemen, Z. Lu, R. Richardson, G. Knight, K. Thirunavukkuarasu, A. Ramirez-Cuesta, Z. Zhu, M. Guo, J. Tang, Z. Xue, Inorg. Chem. **59**, 5218 (2020).

9. Melting of charge order in the low-temperature state of an electronic ferroelectric. N. M. Hassan, K. Thirunavukkuarasu, Z. Lu, D. Smirnov, E. I. Zhilyaeva, S. Torunova, R. N. Lyubovskaya, N. Drichko, npj Quantum Mater. **5,** 15 (2020). Also, in Cond-mat arXiv:1905.12740.

10. Spectroscopic Studies of the Magnetic Excitation and Spin-Phonon Couplings in a Single-Molecule Magnet, S. Stavretis, D. Moseley, F. Fei, H. Cui, Y. Cheng, A. Podlesnyak, X. Wang, L. Daemen, C. Hoffmann, M. Ozerov, Z. Lu, K. Thirunavukkuarasu, D. Smirnov, T. Chang, Y. Chen, A. Ramirez-Cuesta, X. Chen, and Zi-Ling (Ben) Xue, Chem. Eur. J. **25**, 15846 (2019).

11. Spin–phonon couplings in transition metal complexes with slow magnetic relaxation, D. Moseley, S. Stavretis, K. Thirunavukkuarasu, M. Ozerov, Y. Cheng, L. Daemen, J. Ludwig, Z. Lu, D. Smirnov, C. Brown, A. Pandey, A. J. Ramirez-Cuesta, A. Lamb, M. Atanasov, E. Bill, F. Neese, Z. Xue, Nature Communications, **9**, 2572 (2018).

12. Direct observation of very large zero-field splitting in a tetrahedral $NiIISe_4$ co-ordination complex, S. Jiang, D. Maganas, N. Levesanos, E. Ferentinos, S. Haas, K. Thirunavukkuarasu, J. Krzystek, M. Dressel, L. Bogani, F. Neese, P. Kyritsis, J. Am. Chem. Soc., **137**, 12923 (2015).

13. High Photoresponsivity and Short Photo Response Times in Few-Layered WSe2Transistors, N. R. Pradhan, J. Ludwig, Z. Lu, D. Rhodes, M. M. Bishop, K.

Thirunavukkuarasu, S. A. McGill, D. Smirnov, and L. Balicas, ACS Applied Materials and Interfaces **7**, 12080 (2015).

14. Self-normalizing phase measurement in multimode terahertz spectroscopy based on photomixing of three lasers,
K. Thirunavukkuarasu, M. Langenbach, A. Roggenbuck, E. Vidal, H. Schmitz, J. Hemberger, and M. Grüninger,
Appl. Phys. Letters **106**, 031111 (2015), arXiv:1410.0648.

15. Pressure dependence of the exchange anisotropy in an organic ferromagnet,
K. Thirunavukkuarasu, S. M. Winter, C. C.Beedle, A. E. Kovalev, R. T. Oakley, and S. Hill, Phys. Rev. B **91**, 014412 (2015).

16. Group delay in THz spectroscopy with ultra-wideband log-spiral antennae,
M. Langenbach, A. Roggenbuck, I. Cámara Mayorga, A. Deninger,
K. Thirunavukkuarasu, J. Hemberger, and M. Grüninger,
J. Infrared Milli.THz Waves **35**, 918 (2014), (also on arXiv:1406.6589).

17. Electronic and magnetic structure of neutral radical FBBO,
S. M. Winter, A. Mailman, R.T. Oakley, K. Thirunavukkuarasu, S. Hill, D.E. Graf, S.W. Tozer, J. S. Tse, M. Mito, and H. Yamaguchi,
Phys. Rev. B. **89**, 214403 (2014).

18. Enhancing the stability of a continuous-wave terahertz system by photocurrent normalization,
A. Roggenbuck, M. Langenbach, K. Thirunavukkuarasu, H. Schmitz, A. Deninger, I. Cámara Mayorga, R. Güsten, J. Hemberger, and M. Grüninger,
J. Opt. Soc. Am. B, **30**, 1397 (2013).

19. Pressure effects on unoriented and oriented single-walled carbon nanotube films studied by infrared microscopy,
C. A. Kuntscher, A. Abouelsayed, K. Thirunavukkuarasu, F. Hennrich, and Y. Iwasa, J. Appl. Phys. **111**, 112614 (2012).

20. Using a fiber stretcher as a fast phase modulator in a continuous-wave terahertz spectrometer,
A. Roggenbuck, K. Thirunavukkuarasu, H. Schmitz, J. Marx, A. Deninger, I. Cámara Mayorga, J. Hemberger, R. Güsten, and M. Grüninger,
J. Opt. Soc. Am. B **29**, 614 (2012).

21. Rotational dynamics in C_{70}: Temperature- and pressure-dependent infrared studies,
K. Thirunavukkuarasu, V. C. Long, J. L. Musfeldt, F. Borondics, G. Klupp, K. Kamarás, and C. A. Kuntscher, J. Phys. Chem. C **115**, 3646 (2011).

22. Pressure-induced phenomena in single-walled carbon nanotubes: Structural phase transitions and the role of pressure transmitting medium,
C. A. Kuntscher, A. Abouelsayed, K. Thirunavukkuarasu, and F. Hennrich
phys. status solidi B **247**, 2789 (2010).

23. Role of the pressure transmitting medium for the pressure effects in single-walled carbon nanotubes,
A. Abouelsayed, K. Thirunavukkuarasu, F. Hennrich, and C. A. Kuntscher
J. Phys. Chem. C **114**, 4424 (2010).

24. Infrared spectroscopic studies on unoriented single-walled carbon nanotube films under hydrostatic pressure,
K. Thirunavukkuarasu, F. Hennrich, K. Kamarás, and C. A. Kuntscher
Phys. Rev. B **81**, 045424 (2010).

25. Pressure-induced phenomena in single-walled carbon nanotubes probed by infrared spectroscopy,
A. Abouelsayed, K. Thirunavukkuarasu, K.Kamarás, F. Hennrich, and
C.A. Kuntscher, High Pressure Research **29**, 559 (2009).

26. Orientational ordering and intermolecular interactions in the rotor-stator compounds $C_{60}\cdot C_8H_8$ and $C_{70}\cdot C_8H_8$ studied under pressure,
K. Thirunavukkuarasu, C. A. Kuntscher, Gy. Bényei, I. Jalsovszky, G. Klupp,
K. Kamarás, É. Kovats, and S. Pekker, J. Phys. Chem. C **112**, 17525 (2008).

27. Infrared spectroscopy on the fullerene C_{70} under pressure,
K. Thirunavukkuarasu, C.A. Kuntscher, F. Borondics, G. Klupp, and K. Kamarás,
phys. stat. sol. (b) **245**, 2006 (2008).

28. Infrared microreflectance study of magnetically-aligned single-walled carbon nanotubes under pressure,
C.A. Kuntscher, K. Thirunavukkuarasu, K. Kamarás, and F. Simon,
phys. stat. sol. (b) **245**, 2288 (2008).

29. Pressure-induced phenomena in single-walled carbon nanotubes,
C.A. Kuntscher, K. Thirunavukkuarasu, Á. Pekker, K. Kamarás, F. Hennrich, M. Kappes, and Y. Iwasa, phys. stat. sol. (b) **244**, 3982 (2007).

30. Infrared spectroscopy on the rotor-stator compounds $C_{60}\cdot C_8H_8$ and $C_{70}\cdot C_8H_8$ under pressure,
K. Thirunavukkuarasu, C.A. Kuntscher, Gy. Bényei, I. Jalsovszky, G. Klupp,
K. Kamarás, É. Kovats, and S. Pekker, phys. stat. sol. (b) **244**, 3857 (2007).

31. Metal-insulator transition in the low-dimensional organic conductor $(TMTSF)_2FSO_3$ probed by infrared microspectroscopy,
A. Pashkin, K. Thirunavukkuarasu, Y.-L. Mathis, W. Kang, and C. A. Kuntscher,
Eur. Phys. J. B **56**, 285 (2007).

32. Doping dependence of optical properties of low-dimensional perovskite-related $La_{1-y}Ca_yTiO_{3.4\pm\delta}$,
K. Thirunavukkuarasu, F. Lichtenberg, and C.A. Kuntscher,
J.Phys.:Condens.Matter **18**, 9173 (2006).

33. Far- and mid-infrared anisotropy of magnetically aligned single-wall carbon nanotubes studied with synchrotron radiation,

K. Kamarás, K. Thirunavukkuarasu, C.A. Kuntscher, M. Dressel, F. Simon,
H. Kuzmany, D.A. Walters, and D. A. Moss,
Infrared Physics & Technology **49**, 35 (2006).

Conference and Invited Talks

Note: Not all conferences that were attended are listed here

1. **Invited Talk**:
   Colloquium Spring 2021 at Department of Physics, Johns Hopkins University
   Title: ` Probing spin-phonon coupling in magnetic materials using magneto-Raman spectroscopy'
   Date: 28. April 2021
2. **Invited Talk**:
   Colloquium Spring 2021 at University of Massachusetts Lowell, USA
   Title: ` Probing functional materials under extreme conditions'
   Date: 14. April 2021
3. **Invited Talk**:
   86th Annual Meeting of Southeastern Section of American Physical Society (SESAPS), Wrightsville Beach, NC, USA
   Title: ` Low-energy Spectroscopy on Magnetic Materials'
   Date: 8. November 2019
4. **Invited Talk**:
   Department of Navy Opportunities Awareness Workshop, FAMU, Tallahassee, USA
   Title: `Probing functional materials under extreme conditions '
   Date: 22. September 2017
5. **Invited Talk**:
   Oak Ridge National Laboratory, Oak Ridge, Tennessee, USA
   Title: `Probing functional materials under extreme conditions '
   Date: 1. September 2017
6. **Invited Talk**:
   Joint Institute for Advanced Materials, University of Tennessee, Knoxville, Tennessee, USA
   Title: `Probing functional materials under extreme conditions '
   Date: 31. August 2017
7. Conference Talk:
   American Physical Society March Meeting 2017 at New Orleans, USA.
   Title: ` Experimental artifacts influencing polarization sensitive magneto-Raman spectroscopy '
   Date: 16. March 2017
8. Conference Talk:
   American Physical Society March Meeting 2016 at Baltimore, MD, USA.
   Title: `Probing spin excitations using magneto-Raman spectroscopy '
   Date: 16. March 2016
9. Conference Talk:
   American Physical Society March Meeting 2014 at Denver, CO, USA.

Title: `Pressure tuning of anisotropy barrier in Fe8 SMMs probed using high frequency EPR '
Date: 5. March 2014

10. Conference Talk:
South Eastern Magnetic Resonance Conference (SEMRC) 2013, Tallahassee, Florida, USA
Title: `Probing magnetic interactions in molecule-based materials using high-pressure electron paramagnetic resonance'
Date: 12. October 2013
11. Conference Talk:
10^{th} International Symposium on Crystalline Organic Metals Superconductors and Ferromagnets (ISCOM2013) at Montreal, Quebec, Canada.
Title: `Probing magnetic interactions in molecule-based materials using high-pressure electron paramagnetic resonance'
Date: 19. July 2013
12. Conference Talk:
American Physical Society March Meeting 2013 at Baltimore, MD, USA.
Title: `Probing magnetic interactions in molecule-based materials using high-pressure electron paramagnetic resonance'
Date: 18. March 2013
13. Conference Talk:
South Eastern Section of American Physical Society (SESAPS) Meeting 2012 at Tallahassee, FL, USA.
Title: `Low energy spectroscopy on molecular materials under high pressures'
Date: 15. November 2012
14. **Invited Talk**:
Magnetostructural Correlations Workshop 2012, National High Magnetic Field Laboratory, Tallahassee, Florida, USA.
Title: `Pressure-induced phenomena in single-walled carbon nanotubes probed by infrared spectroscopy'
Date: 23. April 2012
15. **Invited Talk**:
1. Physikalisches Institut, Universität Stuttgart, Germany.
Title: `Coherent broadband THz spectrometer using photomixers for accurate determination of complex dielectric function'
Date: 17. April 2012
16. **Invited Talk**:
1. Physikalisches Institut, Universität Stuttgart, Germany.
Title: `Coherent broadband cw-THz spectrometer and its application for spectroscopy at low temperatures and high magnetic fields'
Date: 25. January 2011
17. Conference Talk:
LEES 2010 at Les Diablerets,Switzerland.
Title: `Coherent broadband cw-THz spectrometer: A powerful tool for low-energy solid state spectroscopy'

Date: 08. July 2010

18. Conference Talk:
    German Physical Society (DPG) spring meeting 2010 Regensburg, Germany.
    Title: `Coherent broadband cw-THz spectrometer: A powerful tool for low-energy solid state spectroscopy'
    Date: 22. March 2010
19. **Invited Talk**:
    1. Physikalisches Institut, Universität Stuttgart, Germany.
    Title: `Pressure-induced phenomena in single-walled carbon nanotubes probed by infrared spectroscopy'
    Date: 17. June 2009
20. **Invited Talk**:
    Max Planck Institute for Solid State Research, Stuttgart, Germany.
    Title: 'Pressure-induced phenomena in single-walled carbon nanotubes probed by infrared spectroscopy'
    Date: 06. April 2009
21. Conference Talk:
    German Physical Society (DPG) Spring meeting 2008 Berlin, Germany.
    Title: `Infrared spectroscopy on the rotor-stator compounds $C_{60}\cdot C_8H_8$ and $C_{70}\cdot C_8H_8$ under pressure'
    Date: 06. April 2009
22. Conference Talk:
    German Physical Society (DPG) Spring meeting 2007 Regensburg, Germany.
    `Pressure-induced phenomena in single-walled carbon nanotubes'
    Date: 28. March 2007

Languages

English (excellent), Deutsch (good), Tamil (excellent), Hindi

Computer Skills

LaTex, Office, Origin, Igor, Linux, Programming in C, Labview, Matlab, Inventor

Tallahassee, 3rd September 2021

Komalavalli Thirunavukkuarasu

CHARLES A. WEATHERFORD Ph.D.
Vice President for Research,
Professor of Physics, and
Director of the Center for Plasma Science and Technology
Florida A&M University, Tallahassee, FL 32307

Telephone: (850)-412-5091
Telefax: (850)-412-5096
E-Mail: charles.weatherford@famu.edu

EDUCATION: B.S. in Physics, **1969**, Louisiana State University; Ph.D. in Physics, **1974**, Louisiana State University, major area; Atomic and Molecular Physics, minor area; Solid State Physics

AWARDS: **1999** Professional Excellence Award-Florida A&M U. (FAMU); **2000** Service Award-(FAMU); **2007** Elected Fellow of the National Society of Black Physicists; **2010** Researcher of the Year (FAMU); **2019** Fellow of the American Physical Society.

EMPLOYMENT RECORD: **1974-1977**: Postdoctoral Fellow, FAMU; **1978-Present**: Assistant-, Associate-, Full-Professor, FAMU; Chairperson of Physics: **1989-1999, 2005-October 2013**, FAMU; **2010-Present**--Director of the Center for Plasma Science and Technology, FAMU; **October 2013-Present**--Associate Vice President for Research, FAMU; **November 2014-Present**—Interim Vice President for Research, Interim Executive Director of Title III; Vice President for Research; Sabbatical Goddard Space Flight Center; **Summers at**: IBM-Almaden, NASA-Goddard, NASA-Ames, DOE Lawrence-Livermore, DOE Argonne.

PROFESSIONAL MEMBERSHIPS: American Physical Society, American Chemical Society, National Society of Black Physicists, Society of Industrial and Applied Mathematics

Ph.D.'s Directed:
Dr. Eddie Red (2005), Lawrence-Berkeley Laboratory, Morehouse College.
Dr. Daniel Gebremedhin (2013), FAMU Center for Plasma Science and Technology.
Dr. Boyan Hristov (2018), Florida State University Physics Department

Postgraduate Sponsor of:
(1) Dr. Ahmed Bouferguene, University of Ontario;
(2) Dr. Anil Kumar, J.P University, Chapra, India.;
(3) Paul Oppenheimer, Engineering Research Center-Mississippi State U.;
(4) Dr. Ravi Vadapalli, Engineering Research Center-Mississippi State U.;
(5) Dr. Fernando Sales-Mayor, Florida A&M University;
(6) Dr. Jilin Zhang, Florida A&M University;
(7) Dr. Genzo Tanaka, Florida A&M University;
(8) Dr. Gennady Gutsev, Florida A&M University;
(9) Dr. Daniel Gebremedhin, Florida A&M University.

Graduate Students Sponsored:
FAMU—M.S.: Mei Dong, Roy Tucker, Terrance Dubreus, Albert Wynn, Nantanette Craig, Jahwar Jain, Demetrius Fischer, Johnny Williamson; PhD: Eddie Red, Daniel Gebremedhin, Boyan Hristov, Jessica Tucker.
ERC-Mississippi State U.—co-PhD Director: Glenn Brook;
Florida Atlantic U.—M.S.: Daryl Davis

Charles A. Weatherford received his Ph.D. in Atomic and Molecular Physics theory (Electron-Molecule Scattering with Ronald Henry), and his minor in Solid State Physics theory (with

Joseph Callaway), from Louisiana State University in 1974. He is currently the Associate Vice President for Research, Professor of Physics, Interim Executive Director of Title III, and Director of the Center for Plasma Science and Technology at Florida A&M University. He has a patent disclosure—"Field-Assisted Muon-Catalyzed Fusion." Weatherford has been the principal investigator on grants totaling more than $22M and a co-PI on grants totaling more than $15M, several of which were in STEM education and STEM pipeline projects, typically integrating research into STEM education. His research interests include High Energy Density Science, Few-Body Systems, Multiparticle Dynamics, Correlation in Many-Body Quantum Chemistry, Laser-Matter Interactions, Field-Assisted Muon-Catalyzed Fusion, and Computational Science. He directed the doctoral work of Dr. Eddie Red (2006) and Dr. Daniel Gebremedhin (2013). He recently directed the doctoral work of Boyan Hristov, who graduated in August 2018.

PUBLICATIONS

Dissertation

1. **C.A. Weatherford**,"FrameTransformations in Electron-Molecule Scattering",1974 Dissertation, 256 pages, Louisiana State University, R.J.W. Henry, Director.
2.

Books

1. **C.A. Weatherford** and H.W. Jones, editors, Proceedings of the First International Conference on ETO Multicenter Molecular Integrals, 186 pages, D. Reidel, Holland, 1982.
2. Gennady L. Gutsev, Kalayu G. Belay, Lavrenty G. Gutsev, and **Charles A. Weatherford**, **Modification of the Magnetic Properties of Iron Clusters by Doping and Adsorption: From a Few Atoms to Nanoclusters**, Springer-Verlag 2015 (United Kingdom).
3.

Edited Journals

1. **Charles A. Weatherford** and Philip E. Hoggan, editors of a special edition of the International Journal of Quantum Chemistry in memory of Herbert W. Jones (2004).
2.

Peer-Reviewed (partial list)

1. Anil Kumar, Bidhan C. Saha, and **Charles A. Weatherford**, "Single Electron Capture Cross Sections by Alpha-Particles From the Ground State of K(4s) and Rb(5s): A Molecular State Approach," International Journal of Quantum Chemistry, S**70**, 909-917 (1998).
2. A. Bouferguene, **C.A. Weatherford**, and H.W. Jones, "Addition theorem of Slater-type orbitals: Application to H_2^+ in a strong magnetic field," Physical Review E**59**, 2412-2423 (1999).
3. G.L. Gutsev, P.B. Rozyczko, R.J. Bartlett, and **C.A. Weatherford**, "Does N_2^- Exist? A coupled-cluster study," Journal of Chemical Physics **110**, 5137-5139 (1999).
4. Ahmed Bouferguene, Ignatio Ema, and **Charles A. Weatherford**, "Nonadiabatic polarization potentials in electron- and positron-molecule scattering: Application to e^-+H_2 scattering," Physical Review A**59**, 2712-2718 (1999).
5. A. Kumar, B.C. Saha, **C.A. Weatherford**, and S.K. Verma, "A Systematic Study of Hornbeck Molnar Ionization Involving Rydberg Alkali Atoms," Theochem **487**, 1-9 (1999).
6. B. Ritchie and **C.A. Weatherford**, "Quantum Classical Correspondence in Nonrelativistic Electrodynamics," International Journal of Quantum Chemistry S**75**, 655-658 (1999).
7. B. Ritchie and **C.A. Weatherford**, "Nonperturbative Theory of Coulomb Retardation in Relativistic Quantum Mechanics," Journal of Molecular Structure (Theochem) 529, 113-122 (2000).
8. L. Mott and **C.A. Weatherford**, "Unexpected Constraint Implicit in the Time-Dependent Hartree-Fock Equations," Journal of Molecular Structure (Theochem) 529, 123-126 (2000).
9. B. Ritchie and **C.A. Weatherford**, "Numerical Solution of the Time-Dependent Schrödinger Equation for Continuum States," International Journal of Quantum Chemistry S**80**, 934-941 (2000)
10. **C.A. Weatherford**, "Computational Time-Dependent Two-Electron Theory and Long-Time Propagators," Computational Chemistry: Reviews of Current Trends V. 5, ed. Jerzy Leszczynski, World Scientific, Singapore, 105-140 (2000).

11. R. G. Brook, P.E. Oppenheimer, **C.A. Weatherford**, I. Baniscescu, and J. Zhu, "Solving the Hydrodynamic Formulation of Quantum Mechanics: A Parallel MLS Method," International Journal of Quantum Chemistry S**85**, 263-271 (2001).
12. **C.A. Weatherford**, E. Red, and A. Wynn, "Solution of the time-dependent Schroedinger equation using a basis in time," Journal of Molecular Structure (Theochem) **592**, 47-51 (2002).
13. R.G. Brook, P.E. Oppenheimer, **C.A. Weatherford**, I Banicescu, and J. Zhu, "Accuracy studies of a parallel algorithm for solving the hydrodynamic formulation of the time-dependent Schroedinger equation," Journal of Molecular Structure (Theochem) **592**, 69-77 (2002).
14. **C.A. Weatherford**, E. Red, and A. Wynn, "Designer Polynomials, Discrete Variable Representations, and the Schroedinger Equation," International Journal of Quantum Chemistry **90**, 1289-1294 (2002).
15. R.L. Carino, I. Banicescu, R.K. Vadapalli, **C.A. Weatherford**, T. Dubreus, J. Zhu, "Wavepacket Simulations Using the Quantum Trajectory Method with Loop Scheduling", 2003 High Performance Computing Symposium Advanced Simulation Technologies Conference, Society for Computer Simulation International, 93-99 (2003).
16. R.K. Vadapalli, **C.A. Weatherford**, I. Banicescu, R.L. Carino, and J. Zhu, "Transient Effect of a Free Particle Wave packet in the Hydrodynamic Formulation of the Time-Dependent Schrödinger Equation," International Journal of Quantum Chemistry, **94**, 1-6 (2003).
17. E. Red and C.A. **Weatherford**, "Derivation of a General Formula for the Shibuya-Wulfman Matrix," International Journal of Quantum Chemistry, **100** , 208-213 (2004).
18. R.L. Carino, I. Banicescu, R.K. Vadapalli, **C.A. Weatherford** and J. Zhu, "Message-Passing Parallel Adaptive Quantum Trajectory Method," in High Performance Scientific and Engineering Computing, L.T. Yang and Y. Pan, Editors, Kluwer Chap. 9, pp. 127-139, 2004.
19. J.L. Jain, H.W. Jones, **C.A. Weatherford**, and P.E. Hoggan, "Closed Formulae For (1s|1s), Slater Two-Center Integrals, using the Three Center Nuclear Attraction Integral Program in Spherical Coordinates," International Journal of Quantum Chemistry, **100**, 199-205 (2004).
20. B. Ritchie and **C.A. Weatherford**, "Time-Dependent Non-Wavepacket Theory of Electron Scattering," International Journal of Quantum Chemistry, **100**, 710-712 (2004).
21. B. Ritchie and **C.A. Weatherford**, "Relativistic Electron Theory: Is Spin a Property of the Electron in Vacuo or of the Electromagnetic Field Interaction," International Journal of Quantum Chemistry **100**, 1014-1018, 2004.
22. **Charles A. Weatherford** and Philip Hoggan, "Solution of the Poisson Equation Using Coulomb Forms," in Molecular Quantum Mechanics: The No Nonsense Path to Progress, An International Conference in Honour of Nicholas C. Handy, P1.64, July 24-29, 2004, St. John's College, Cambridge University, England.
23. Philip E. Hoggan and **C.A. Weatherford**, "In Memory of Herbert W. Jones (1927-2002)," International Journal of Quantum Chemistry **100**, 67-68 (2004).
24. **C.A. Weatherford,** E. Red, and P. Hoggan, "Solution of Poisson's Equation Using Spectral Forms," Molecular Physics **103**, 2169-2172 (2005).
25. **C.A. Weatherford,** E. Red, D. Joseph, and P. Hoggan, "Poisson's Equation Solution of Coulomb Integrals in Atoms and Molecules," Molecular Physics **104**, 1385-1389 (2006).
26. Genzo Tanaka and **C.A. Weatherford**, "Decomposition Pathways of Dintrotoluene", International Journal of Quantum Chemistry **108**, 2924-2934, 2008.
27. Y.M. Shulga, V.M. Martynenko, S.A. Baskakov, A.N. Trukhanenok, E.M. Anokhin, A.V. Maksimychev, S.S. Khasanov, K.G. Belay, **C.A. Weatherford**, G.L. Gutsev, "Synthesis and properties of C_{60} fullerite intercalated by acetylene," Chemical Physics Letters **483**, 115-119 (2009).
28. G.L. Gutsev, M.D. Mochena, B.C. Saha, **C.A. Weatherford**, and P.A. Derosa, "Structure and Properties of $(GaAs)_n$ Clusters", Journal of Computational and Theoretical Nanoscience **7**, 254-263 (2010).
29. G. L. Gutsev, K. G. Belay, **C. A. Weatherford**, V. N. Vasilets, E. M. Anokhin, A. V. Maksimychev, V. M. Martynenko, S. A. Baskakov, A. N. Trukhanenok, E. S. Leskova, Y. M. Shulga, "Dimerization of defect fullerenes and peculiarities of the orientational phase transition in oxidized C_{60} fullerite", Journal of Nanoscience and Nanotechnology **10**, 1-10 (2010).

30. G. L. Gutsev, R. H. O'Neal, Jr., K. G. Belay, **C. A. Weatherford**, "Non-quantum-confinement behavior of small $(CdS)_n$ clusters", Chemical Physics **368**, 113-120 (2010).
31. G.L. Gutsev, **C.A. Weatherford**, K. Pradhan, and P. Jena, "Structure and Spectroscopic Properties of Iron Oxides with the High Content of Oxygen: FeO_n and FeO_n^- (n=5–12)," Journal of Physical Chemistry A **114**, 9014-9021 (2010).
32. P. Karamanis, C. Pouchan, **C.A. Weatherford**, G.L. Gutsev, "Evolution of Properties in Prolate (GaAs)n Clusters", Journal of Physical Chemistry C, **115**, 97-107 (2011).
33. G. L. Gutsev, K. G. Belay, **C. A. Weatherford**, V. N. Vasilets, E. M. Anokhin, A. V. Maksimychev, O. V. Val'ba, V. M. Martynenko, S. A. Baskakov, E. S. Leskova, and Y. M. Shulga "Dimerization of Defect Fullerenes and the Orientational Phase Transition in Oxidized C_{60} Fullerite," Journal of Nanoscience and Nanotechnology **11**, 1887-1896 (2011).
34. Daniel Gebremedhin and **Charles A. Weatherford**, "Two-Range Addition Theorem for Coulomb Sturmians", Progress in Theoretical Chemistry and Physics B22, 71-81, P. E. Hoggan, E.J. Brändas, J. Maruani, P. Piecuch, and G. Delgado-Barrio, editors, Springer, Dordretch (2011).
35. K. Pradhan, G. L. Gutsev, **C. A. Weatherford**, P. Jena, "A systematic study of neutral and charged 3d-metal trioxides and tetraoxides", Journal of Chemical Physics 134, 144305-1-10 (2011).
36. K. Pradhan, G.L. Gutsev, **C.A. Weatherford**, and P. Jena, "Interactions of a Mn Atom With Halogen Atoms and Stability of Its Half-Filled 3d-Shell", Journal of Chemical Physics **134**, 234311-8 (2011).
37. G.L. Gutsev, **C.A. Weatherford**, K. Pradhan, and P. Jena, "Density Functional Study of Neutral and Anionic AlO_n and ScO_n with High Oxygen Content," Journal of Computational Chemistry **32**, 2974-2982 (2011).
38. Gennady L. Gutsev, **Charles A. Weatherford**, Lewis E. Johnson, Purusottam Jena, "Structure and Properties of the Aluminum Borates $Al(BO_2)_n$ and $Al(BO_2)_n^-$, (n=1-4)", Journal of Computational Chemistry **33**(4), 416-424 (2012).
39. Yuriy Shulga, Sergey Baskakov, Vyacheslav Muradyan, Dmitriy Voilov, Vyacheslay Smirnov, Alexander Michtchenko, José Cabañas-Moreno, Kalayu Belay, **Charles Weatherford**, and Gennady L. Gutsev, "Colorful Polymer Compositions With Dyed Graphene Oxide Nanosheets", International Scholarly Research Networks Optics **2012**, 1-5 (2012).
40. Gennady Gutsev, **Charles Weatherford**, Puru Jena, Elijah Johnson, Bala Ramachandran, "Structural Patterns in Carbon Chemisorption on an Icosahedral Iron Clusters", Journal of Physical Chemistry B, **116** 7050-7061 (2012).
41. James B. Titus, Alonzo B. Alexander, Kyron Williams, **Charles Weatherford**, and Joseph A. Johnson III, "FAMU Spheromak and the Turbulent Physics Experiment—STPX", Technology and Innovation **14**, 1-11, 2012.
42. B. Ritchie, **C. Weatherford,** "Algebra of Physical Space and the Geometric Space-Time Solution of Dirac's Equation," International Journal of Quantum Chemistry, DOI: 10.1002/qua.24156 (2012).
43. G.L. Gutsev, **C.A. Weatherford**, P. Jena, E. Johnson, and B.R. Ramachandran, "Structure and Properties of Fe, Fe^-_n, Fe^+_n Cluster, n=7-20", Journal of Physical Chemistry A **116**, 10218-10228 (2012).
44. D.H. Gebremedhin and **C.A. Weatherford**, "Canonical Two-Range Addition Theorem for Slater-Type Orbitals," International Journal of Quantum Chemistry **113,** 71-75 (2013).
45. Burke Ritchie and **Charles A. Weatherford**, "Quantum-Dynamical Theory of Electron Exchange Correlation", Advances in Physical Chemistry **2013**, 1-8, dx.doi.org/10.1155/2013/497267 (2013).
46. Gennady Gutsev, **Charles A. Weatherford**, Purusottam Jena, Elijah Johnson, Bala R Ramachandran, "Competition Between Surface Chemisorption and Cage Formation in $Fe_{12}O_{12}$ Cluster", Chemical Physics Letters **556**, 211-216 (2013).
47. G.L. Gutsev, **C.A. Weatherford**, K.G. Belay, B.R. Ramachandran, and P. Jena, "All-electron density functional theory study of the structure and properties of the neutral and singly charged M_{12}, and M_{13} clusters: M=Sc-Zn", Journal of Chemical Physics **138**, 164303-1 – 13 (2013).
48. G.L. Gutsev, L.E. Johnson, K.G. Belay, **C.A. Weatherford**, L.G. Gutsev, B.R. Ramachandran, "Structure and Magnetic Properties of Fe_nGd Clusters, n=12-19", European Journal of Physics D **68**, 81-89 (2014).

49. G.L. Gutsev, L.E. Johnson, K.G. Belay, **C.A. Weatherford**, L.G. Gutsev, B.R. Ramachandran, "Structure and Magnetic Properties of $Fe_{12}X$ Clusters", Chemical Physics **430**, 62-68 (2014).
50. Burke Ritchie and **Charles A. Weatherford**, "Two-Body Dirac Theory", Physical Science International Journal **4(6)**, 797-815 (2014).
51. Daniel H. Gebremedhin and **Charles A. Weatherford**, "Calculations for the One-Dimensional Soft Coulomb Problem and the Hard Coulomb Limit", Physical Review E **89**, 053319-1-053319-6 (2014).
52. **Charles Weatherford** and Daniel Gebremedhin, "The One-Dimensional Soft-Coulomb Problem and the Hard-Coulomb Limit", Bulletin of the American Physical Society **59**, 95 (2014), 45th DAMOP, June 2-6, 2014, Madison, Wi.
53. Daniel H. Gebremedhin and **Charles A. Weatherford**, "Reply to 'Comment Paper on "Calculations for the one-dimensional soft Coulomb problem and the hard Coulomb limit" ' ", Physical Review E91, 027302-1-027302-3 (2015).
54. Daniel H. Gebremedhin and **Charles A. Weatherford**, "Application of the Space-Pseudo-Time Method to Density Functional Theory", in Philip E. Hoggan, Telhat Ozdogan, editors: **Electron Correlation in Molecules—ab initio Beyond Gaussian Quantum Chemistry**, Vol 73, AIQ, UK: Academic Press, 2016, pp. 231-247.
55. Gennady Gutsev, Kalayu Belay, **Charles Weatherford**, Bala Ramachaandran, Lavrenty Gutsev, and Puru Jena, "Structure and Properties of Polyfluoride F^-_n Clusters (n=3-29)", Journal of Physical Chemistry **119**, 6483-6492 (2015).
56. Lavrenty Gutsev, Naresh Dalal, Balu Ramachandran, and **Charles Weatherford**, "Spectral Signatures of Semiconductor Clusters: $(CdSe)_{16}$ Isomers", Chemical Physics Letters **636**, 121-128 (2015).
57. Gennady Gutsev, **Charles Weatherford**, Bala Ramachandran, Lavrenty Gutsev, Weijun Zheng, Owen Thomas, Kit Bowen, "Photoelectron Spectra and Structure of the M_{nn}^- Anions (n=2-16)", Journal of Chemical Physics **143**, 044306 (2015).
58. Daniel Gebremedhin and **Charles Weatherford**, "One-Particle Effective Potential for Helium Atom", In Philip Hoggan, editor: Novel Electronic Structure Theory: General Innovations and Strongly Correlated Systems, Vol 76, AIQ, UK: Academic Press, 2018, pp. 211-222.
59. Boyan Hristov, David C. Collins, Peter Hoeflich, **Charles Weatherford** and Tiara R. Diamond, "MHD Effects ON Nuclear Burning During Deflagration OF IA SN", The Astrophysical Journal, 858:13 **(**12pp**)**, 2018 May 1.
60. Daniel Gebremedhin, **Charles Weatherford**, and Brian Wilson, "Normalizing Cluster Wavefunctions in the Interstitial Region of the Watson Sphere", In Philip Hoggan, editor: Novel Electronic Structure Theory: General Innovations and Strongly Correlated Systems, Vol 77, AIQ, UK: Academic Press, 2019.

Florida Agricultural and Mechanical University
TALLAHASSEE, FLORIDA 32307-3200
Excellence With Caring
TELEPHONE: (850) 599-3276
FAX: (850) 561-2551
OFFICE OF THE PROVOST AND
VICE PRESIDENT FOR ACADEMIC AFFAIRS

March 1, 2011

Dr. Robert Bradley
Interim Provost
Florida State University
212 Westcott
Tallahassee, FL 32306

Dear Dr. Bradley:

Thank you for sharing with me a copy of Florida State University's (FSU) proposal for a PhD in Materials Science. Former Dean Chen and Dr. Eric Hellstrom have discussed the proposal with me.

Florida A&M University (FAMU) is supportive of this proposal to establish an interdisciplinary PhD program administered by the Graduate School at FSU. The proposed degree appears to provide opportunities to students in a field that is important to the State of Florida, and to have the potential for cooperation between our two institutions that would be mutually beneficial. FAMU faculty in the joint College of Engineering may participate, as appropriate, provided that their responsibilities pertaining to FAMU are not adversely affected. We do not want the initiation of this program by FSU to preclude FAMU from initiating its own MS and PhD degree programs in Materials Science in the future in niche areas that are not duplicative of FSU's research efforts. We would appreciate FSU's expression of support of FAMU, should we seek to implement MS and PhD degrees in Materials Science in the future, and your offer to collaborate on such an endeavor, thus making efficient use of the resources at the two universities.

Sincerely,

Cynthia Hughes Harris

Cynthia Hughes Harris, PhD
Provost and Vice President for Academic Affairs

Cc Dr. John Collier, Interim Dean FAMU-FSU College of Engineering
Dr. Eric Hellstrom

STATE UNIVERSITY SYSTEM OF FLORIDA

Board of Governors, State University System of Florida

REQUEST TO OFFER A NEW DEGREE PROGRAM

In Accordance with BOG Regulation 8.011

(Please do not revise this proposal format without prior approval from Board staff)

Florida A&M University	**Fall 2023**
Institution Submitting Proposal	**Proposed Implementation Term**
FAMU-FSU College of Engineering	
Name of College(s) or School(s)	**Name of Department(s)/Division(s)**
Materials Science Engineering	**Ph.D. in Materials Science and Engineering**
Academic Specialty or Field	**Complete Name of Degree**
40.1001 (14.1801)	
Proposed CIP Code (2020 CIP)	

The submission of this proposal constitutes a commitment by the university that, if the proposal is approved, the necessary financial resources and the criteria for establishing new programs have been met prior to the initiation of the program.

Date Approved by the University Board of Trustees	**President's Signature** **Date**
Board of Trustees Chair's Signature **Date**	**Provost's Signature** **Date**

PROJECTED ENROLLMENTS AND PROGRAM COSTS

Provide headcount (HC) and full-time equivalent (FTE) student estimates for Years 1 through 5. HC and FTE estimates should be identical to those in Appendix A – Table 1. Indicate the program costs for the first and the fifth years of implementation as shown in the appropriate columns in Appendix A – Table 3A or 3B. Calculate an Educational and General (E&G) cost per FTE for Years 1 and 5 by dividing total E&G by FTE.

Implementation Timeframe	HC	FTE	E&G Cost per FTE	E&G Funds	Contract & Grants Funds	Auxiliary/ Philanthropy Funds	Total Cost
Year 1	2	2	$20,323	$40,647	$49,585		$90,232
Year 2	2	2					
Year 3	3	3					
Year 4	4	4					
Year 5	5	5	$8,129	$40,647	$109,585		$150,232

Additional Required Signatures

I confirm that I have reviewed and approved Need and Demand Section III.F. of this proposal.

Signature of Equal Opportunity Officer	**Date**

I confirm that I have reviewed and approved Non-Faculty Resources Section VIII.A. and VIII.B. of this proposal.

Signature of Library Dean/Director	**Date**

Introduction

I. Program Description and Relationship to System-Level Goals

A. Describe within a few paragraphs the proposed program under consideration, and its overall purpose, including:

- **degree level(s)**
- **majors, concentrations, tracks, specializations, or areas of emphasis**
- **total number of credit hours**
- **possible career outcomes for each major (provide additional details on meeting workforce need in Section III)**

Florida A&M University proposes to offer an interdisciplinary doctoral degree program in Materials Science and Engineering (MS&E) beginning Spring 2023. The proposed program will be offered jointly within the FAMU-FSU College of Engineering and utilize faculty that currently teach within the existing MS&E program at Florida State University (FSU), related programs in the College, and Physics and Chemistry departments on the Main campus of FAMU.

Completion of the doctoral program requires a minimum of 54 credits, including a minimum of 27 credits of letter-graded courses and a minimum of 24 credits of doctoral-level research. In their first year, students will gain a firm grounding in the fundamentals of MS&E through core courses (12 credits) taught by faculty members from different departments (these courses are already available). The student and their research advisor will determine which elective specialization courses are best for their research. Students will also register for the existing weekly Interdisciplinary Seminar Series (ISS), taken every semester through graduation (0 credits). In the ISS, students will be exposed to FAMU and FSU faculty and external researchers working in the area of MS&E. They will learn presentation skills and present their research. Importantly, ISS is the glue that binds the MS&E students as a community, as they will be doing their research in far-flung labs on the main FAMU campus, in the FAMU-FSU College of Engineering, or in Innovation Park.

As background information, Materials Science is defined by the National Center for Education Statistics (NCES) under CIP Code 40.1001 as " A program that focuses on the general application of mathematical and scientific principles to the analysis and evaluation of the characteristics and behavior of solids, including internal structure, chemical properties, transport, and energy flow properties, thermodynamics of solids, stress and failure factors, chemical transformation states and processes, compound materials, and research on industrial applications of specific materials." Historically, periods have been referenced to materials, such as the Stone Age, the Bronze Age, the Iron Age, and most recently, the Silicon Age. A similar CIP code (14.1801) exists in a related discipline, materials engineering and is utilized at other SUS institutions. In today's society, familiarity with materials is based on current technologies that depend on advanced materials that improve people's lives like batteries that power electronic devices and electric vehicles; solar cells for green energy; integrated circuits, solid-state memory, and displays for electronic devices; lightweight, smart prostheses; and advanced composites (more than 50% by weight) in the latest generation of commercial aircraft. The MS&E program at FAMU and FSU will allow students to gain specialty in areas of magnetic materials, materials for 3-D printing, nano biomaterials, multifunctional polymers, sensors for structural materials, catalysts, and electrolytes for batteries.

Materials Science and Engineering programs were created at FSU in 2008 and were administered by the FSU Graduate School until Spring 2021, when they were moved to the FAMU-FSU College of Engineering (COE). The Materials Science and Engineering degree (master's and doctoral) programs now residing in the FAMU-FSU COE create an opportunity for FAMU students to participate by creating a joint program between the Universities, similar to all other programs within the College. Additionally, the programs create opportunities for increased collaboration between faculty on the main FAMU campus, specifically in Chemistry and Physics. The programs will also increase the number of graduate degrees awarded in STEM; an Area of Strategic Emphasis identified by the Board of Governors.

The MS&E program at FAMU and FSU will advance the State and Federal calls to increase competence in science, technology, engineering, and math (STEM) in upcoming generations and to promote interdisciplinary approaches to solve fundamental problems in a global environment. Specifically in Florida, the aerospace industry is an essential component of the State's economy. Further, the military and NASA drive the development of new materials because improved performance materials are paramount for them. As such, there are several federal research laboratories in the Panhandle region, including Eglin and Tyndall AFBs, the Naval Surface Warfare Center, and the Naval Air Station Pensacola, that need new, well-trained MS&E graduates in their workforce. In addition, many industries in Florida, like defense and aerospace contractors, need materials science and engineering research. With the advanced knowledge gained in materials science and related areas of chemistry and physics, graduates from the proposed program will be able to apply knowledge gained from understanding, developing, testing, and applying materials that will form the foundation for present and future technologies. Doctoral-trained graduates are also eligible for careers in academia.

B. If the proposed program qualifies as a Program of Strategic Emphasis, as described in the Florida Board of Governors 2025 System Strategic Plan, please indicate the category.

- **Critical Workforce**
  - ☐ Education
  - ☐ Health
  - ☐ Gap Analysis
- **Economic Development**
  - ☐ Global Competitiveness
  - ☒ Science, Technology, Engineering, and Math (STEM)

☐ **Does not qualify as a Program of Strategic Emphasis.**

II. Strategic Plan Alignment, Projected Benefits, and Institutional Mission and Strength

A. Describe how the proposed program directly or indirectly supports the following:

- **System strategic planning goals (see link to the 2025 System Strategic Plan on the New Program Proposals & Resources webpage)**
- **the institution's mission**
- **the institution's strategic plan**

The MS&E programs contributes directly to several of the State University System (SUS) Strategic Planning Goals in the 2025 System Strategic Plan. The specific areas in which the master's in MS&E will impact or contribute are:

Teaching and Learning:

- Strengthen Quality and Reputation of the Universities
- Increase Degree Productivity & Program Efficiency. The proposed degree will increase degree productivity within the FAMU-FSU College of Engineering as a joint College and graduate degree production at FAMU.
- Increase the Number of Degrees Awarded in Programs of Strategic Emphasis. The program falls under the category of STEM; thereby, increasing the number of degrees awarded in areas of strategic emphasis and areas of high demand for employers.

Scholarship, Research and Innovation:

- Strengthen the Quality and Reputation of Scholarship, Research, and Innovation. Faculty within the program and related disciplines will be able to pursue additional grants from their research associated with the various areas of materials, such as, magnetic materials, materials for 3-D printing, nano biomaterials, multifunctional polymers, sensors for structural materials, catalysts, and electrolytes for batteries.

- Increase Research Activity and Attract More External Funding

The MS&E program is also consistent with FAMU's mission. Florida Agricultural and Mechanical University (FAMU) is an 1890 land-grant institution dedicated to the advancement of knowledge, resolution of complex issues and the empowerment of citizens. FAMU's distinction as a doctoral/research institution will continue to provide mechanisms to address emerging issues through local and global partnerships. Expanding upon the University's land-grant status, it will enhance the lives of constituents through innovative research, engaging cooperative extension, and public service.

In direct support of its mission, the proposed MS&E programs align with FAMU's dedication to the "advancement of knowledge and resolution of complex issues". Materials engineers and materials scientists "plan and carry out complex research projects, such as the development of new products and testing methods" (BLS, 2021). According to the Bureau of Labor Statistics, "the number of scientific research projects that involve multiple disciplines is increasing, and it is common for materials scientists to work on teams with other scientists, such as biologists, physicists, computer specialists, and engineers". Each of these areas are aligned with degree programs in areas of strategic emphasis and are offered at both FAMU and FSU.

Further, advances in materials science and engineering are steadily rising with the increase in building materials, human services, batteries, nanotechnology, etc. As these areas continue to emerge, graduates of FAMU's MS&E program will be equipped to handle complex problems utilizing creative thinking to address real world problems associated with the advances of materials science consistent with the mission. Doctoral-prepared graduates will also be able to use the knowledge gained in the classroom and through research to teach and provide training in postsecondary institutions or oversee high-intensive research labs at the federal and state levels.

Along with the Board of Governor's 2025 Strategic Plan and FAMU mission, the proposed MS&E programs aligns well with FAMU's goal for High Impact Research, Commercialization, Outreach, and Extension Services. Specific to Strategic Priority 3 of the FAMURising, the master's in MS&E will address the following goals:

- Goal 1: Expand and enhance cutting-edge research and creative scholarship for the benefit of the state of Florida, the nation, and the world
- Goal 2: Increase research productivity, commercialization and return on investment
- Goal 3: Increase the number of nationally recognized graduate programs

FAMU and FSU have faculty in STEM fields who will collaborate in the interdisciplinary MS&E master's program. At FAMU, faculty from engineering, physics, and chemistry will participate at the onset. As the program grows, additional faculty will be added to the program. Current faculty from both institutions have been successful writing proposals and receiving external funding to do cutting edge research. As the MS&E M.S. program will help attract additional graduate students, greater contributions to the SUS Strategic Planning Goals and the FAMU Strategic Plan are anticipated. Further, this program supports the FAMU and SUS missions of educating more diverse students in high-tech STEM fields to compete in the 21st century global economy.

B. Describe how the proposed program specifically relates to existing institutional strengths. This can include:

- **existing related academic programs**
- **existing programs of strategic emphasis**
- **institutes and centers**
- **other strengths of the institution**

FAMU-FSU College of Engineering ranks as the #2 doctoral-granting undergraduate engineering school in Florida by U.S. News and World Report. The College is also ranked #4 for graduate engineering among public schools in Florida. This is a testament of the strength of FAMU and FSU programs' strengths in areas of strategic emphasis. Additionally, FAMU and FSU faculty within the joint College and departmental faculty collaborating in materials science conduct high-quality research leading to sustainable solutions for today's economy.

MS&E faculty members and their students will have access to appropriate lab space and shared facilities in the National High Magnetic Field Laboratory (NHMFL). Faculty also utilize and conduct research in the NSF-CREST grant space within the NHMFL and within

the High-Performance Materials Institute (HPMI) in Innovation Park. In addition, space is being remodeled in FAMU's Centennial Research Building for a recent new hire doing materials related research. All these facilities (NHMFL, HPMI, and the Centennial Building) are adjacent to the FAMU-FSU College of Engineering.

FAMU has a strong record as a Top 100 producer of graduate degrees to minorities as evidenced in its rankings by Diverse Issues in Higher Education. In the 2019 publication of Diverse Issues, FAMU is ranked #28 for graduate degrees in engineering awarded to African Americans. Florida State University is ranked #98 in the production of engineering degrees awarded to Hispanics. Because the MS&E program will build on the academic strengths of both institutions and faculty teaching jointly in the FAMU-FSU College of Engineering, students will have increased exposure to diverse experiences to support high achievement in the classroom.

C. Provide the date the pre-proposal was presented to the Council of Academic Vice Presidents Academic Program Coordination (CAVP ACG). Specify whether any concerns were raised, and, if so, provide a narrative explaining how each concern has been or will be addressed.

The CAVP proposal for FAMU's proposed master's degree in Materials Science and Engineering was presented on September 2nd at the fall 2021 meeting. Members of the group voiced support for the program as an addition to the State University System and joint FAMU-FSU College of Engineering. No formal concerns were noted.

D. In the table below, provide a detailed overview and narrative of the institutional planning and approval process leading up to the submission of this proposal to the Board office. Include a chronology of all activities, providing the names and positions of both university personnel and external individuals who participated in these activities.

- **If the proposed program is a bachelor's level, provide the date the program was entered into the APPRiSe system, and, if applicable, provide narrative responding to any comments received from APPRiSe.**
- **If the proposed program is a doctoral-level program, provide the date(s) of the external consultant's review in the planning table. Include the external consultant's report and the institution's responses to the report as Appendix B.**

Up until Jan. 1, 2021, the MS&E graduate programs resided in the Graduate School at FSU. Because during its implementation the program was only approved at FSU, faculty involved in the program were employed by FSU and admissions was limited to FSU students. As the program grew, FAMU faculty from the FAMU-FSU College of Engineering began to participate in the program in 2013. Although faculty were able to participate, FAMU as an institution could not enroll students.

As the years progressed and under new leadership within the FAMU-FSU College of Engineering, discussions ensued between the former dean of the College (J. Murray Gibson, Ph.D.), the director of the program (Eric Hellstrom, Ph.D.) and the dean of the Graduate School (Mark Riley, Ph.D.) regarding the possibility of moving the program to the FAMU-FSU College of Engineering. Benefits noted for the move included: increased

visibility of the program, increased enrollment, greater participation from faculty in the College, and opportunities for FAMU students to enroll in the program. In June 2020, institutional administration and program faculty agreed to change the location of the program to the FAMU-FSU College of Administration and include it as interdisciplinary program with Professor E. Hellstrom continuing to serve as the Director. MS&E was transferred effective Jan. 1, 2021.

At the same time discussions were being held to move the programs to the College, former Dean Gibson and program faculty were having planning meetings with FAMU Provost Maurice Edington and FAMU Assistant Vice President of Program Quality Sundra Kincey about the possibility of adding the same degrees at FAMU to create synergistic opportunities for its students. Formal representation of the College's objectives to add degrees in MS&E at FAMU were included in the College's strategic goals and presented to Provost Edington on Sept. 28, 2020.

After MS&E was moved to the FAMU-FSU College of Engineering, formal steps were taken to begin developing a proposal for the FAMU MS&E program. Prior to development of the required CAVP pre-proposal, former Dean Gibson proposed the idea and goals for graduate programs in MS&E at FAMU at the July 20, 2021 meeting of the FAMU-FSU COE Joint Council. The Council indicated support for the degree. Following, discussions were held with Board of Governors staff and FAMU Board of Trustees regarding FAMU's intent to develop new graduate programs in MS&E with a proposed implementation date of Spring 2023.

There were several meetings with FAMU faculty and administration in early Sept. 2021. On Sept. 1, 2021, Hellstrom met by Zoom with Dean Richard Alo (FAMU College of Science and Technology) and some of his staff, and Professors Nelly Mateeva and Bidhan Saha (department chairs of Chemistry and Physics, respectively) to explain the existing FSU MS&E program and answer questions. On Sept. 3, 2021, Hellstrom met by Zoom with faculty employed on FAMU lines in the FAMU-FSU College of Engineering, Dean Gibson and AVP Kincey to talk about creating the program and get the faculty member buy-in to create the program. On Sept. 7, 2021 there was a Zoom meeting with Provost Edington, AVP Kincey, Dean Richard Alo (FAMU College of Science and Technology) and his staff members, plus staff members from the BOG to talk about details for submitting the proposal to be considered at the June 2022 BOG meeting. On Sept. 13, 2021, Hellstrom met by Zoom with members of the FAMU chemistry department to explain the existing MS&E Ph.D. program and answer further questions. Submission to the FAMU BOT is planned for the April 2022 meeting.

The table below provides a visual synopsis of the prior narrative.

Planning Process

PLANNING PROCESS		
Date	**Participants**	**Planning Activity**
Planning activities to move MS&E from Graduate School to FAMU-FSU COE, which was needed to be able to create the joint FAMU-FSU MS&E program		
Dec. 19, 2019	Dean Gibson, Eric Hellstrom, Huckaba, Mark Riley	Met to discuss moving MS&E from the FSU Graduate school to the FAMU-FSU COE

PLANNING PROCESS		
Date	**Participants**	**Planning Activity**
Feb. and June, 2020	MS&E faculty members plus Dean Gibson, Huckaba, Mark Riley	All MS&E faculty members alerted by email about plans to move MS&E from the Graduate School to FAMU-FSU COE. MS&E faculty were asked for comments and concerns.
Summer and Fall 2020	Dean Gibson and FSU administration	Working to move MS&E from the Graduate School to FAMU-FSU COE
Jan. 1, 2021	FSU and FAMU-FSU COE administration	MS&E officially transferred from Graduate school to FAMU-FSU COE
Planning activities to create the FAMU MS&E M.S. program		
Sept. 28, 2021	Provost Maurice Edington, Dean Murray Gibson	Presentation to FAMU Provost by former Dean Gibson to formally move MS&E to FAMU-FSU COE, which would allow creating FAMU MS&E M.S. program.
July 20, 2021	FAMU-FSU COE Joint Council	Presentation to FAMU Provost by former Dean Gibson to the FAMU-FSU COE Joint council.
Aug. 16, 2021	Provost Maurice Edington Dean Murray Gibson, Eric Hellstrom, Director Program Faculty Institutional Level Committee (UPARC)	CAVP Proposals reviewed and approved by FAMU Internal Committee and Provost
Sept. 1, 2021	College of Science and Technology Dean, Richard Alo and administrative team Eri Hellstrom, Director Nelly Mateeva, Department Chair (Chemistry) Saha Bidhan, Department Chair, (Physics)	Discussion of feasibility of FAMU MS&E programs and potential collaborations from Chemistry and Physics departments
September 2, 2021	CAVP Academic Coordination Group	CAVP Pre-Proposal Approval
Sept. 3, 2021	Jaamel Ali, Prof. CBE Natalie Arnett, Prof. CBE Tarik Dickens, Prof. IME Subramanian Ramakrishnan, Prof. CBE Murray Gibson, Dean Eric Hellstrom, Director Sundra Kincey, Asst. VP of Program Quality	FAMU MS&E programs and potential collaborations from Chemistry and Physics departments
Sept. 7, 2021	FAMU Academic Affairs Leadership FAMU-FSU College of Engineering Administrators Program Faculty (Engineering, Chemistry, Physics)	Q&A with FAMU and Board of Governors Staff Members
Sept. 13, 2021	College of Science and Technology Dean, Richard Alo and administrative team Eri Hellstrom, Director Nelly Mateeva, Department Chair (Chemistry) Saha Bidhan, Department Chair, (Physics)	FAMU MS&E collaborative partner discussions
September/October 2021	President, Provost, Faculty Senate, University Curriculum Committee	Approval of MS&E Proposal by FAMU Internal Administrators and Committee

PLANNING PROCESS		
Date	**Participants**	**Planning Activity**
June 2022	FAMU Board of Trustees	Approval of MS&E Proposal by FAMU Board of Trustees

E. Provide a timetable of key events necessary for the implementation of the proposed program following approval of the program by the Board office or the Board of Governors, as appropriate, and the program has been added to the State University System Academic Degree Program Inventory.

Events Leading to Implementation

Date	Implementation Activity
June - July 2022	Board of Governors Staff Review for BOG Consideration
June – July 2022	Develop MOUs between collaborating departments
July – September 2022	Collaborate with BOG Staff in Preparation for November BOG Meeting
November 2022	Review by BOG
Spring 2023	Marketing and recruitment of students
Spring 2023	Update internal systems
Fall 2023	Enroll first cohort

Institutional and State Level Accountability

III. Need and Demand

A. Describe the workforce need for the proposed program. The response should, at a minimum, include the following:

- **current state workforce data as provided by Florida's Department of Economic Opportunity**
- **current national workforce data as provided by the U.S. Department of Labor's Bureau of Labor Statistics**
- **requests for the proposed program from agencies or industries in your service area**
- **any specific needs for research and service that the program would fulfill**

Materials science experimental, computational, and theoretical research forms an important vehicle to create new materials and improve existing materials that underpin developing new technologies in medicine, energy, transportation, electronics, communications, information, building, construction, homeland security and national defense. Many major federal funding agencies, including the National Science Foundation, Department of Energy, Department of Defense, and NASA support large research programs in materials science and engineering. In addition, many companies employ materials in their products and need employees who are knowledgeable about materials science.

High technology industries have an increasing need for materials scientists, including in manufacturing, automotive, aerospace, catalysis, electronics, construction, medical science, and nanotechnology. The Bureau of Labor Statistics states that "Employment of materials engineers is projected to grow eight percent from 2020 to 2030". Growth is expected to be particularly strong for materials scientists and engineers working on nanomaterials and biomaterials. Also, according to the Aerospace Industries Association, there will be a need for more people in the aerospace industries, including materials scientists, as baby boomers retire, and the industry creates more advanced designs with more outstanding capabilities and higher efficiencies.

Florida has a strong national presence in key economic sectors such as aerospace, defense, marine and space. Lockheed Martin, Boeing, Raytheon, Northrop Grumman, and General Dynamics – top aerospace/defense companies in the U.S. – all have substantial operations in Florida, and all employ materials scientists. New materials are key to advances in these industries, such as the carbon-fiber composites being used in military aircraft and the latest commercial Boeing and Air Bus planes. On the national level, well-known companies in which materials scientists and engineers play key roles include 3M, Apple, Alcoa, Boeing, Cummins, DuPont, Exxon Mobil, General Dynamics, GE, General Motors, HP, IBM, Intel, Lockheed Martin, Motorola, and Xerox. The MS&E graduates can also work in research and development in national labs, and industrial labs.

The increasing budget and scales of federal agencies' SBIR/STTR programs in MS&E fields have created and will continue to have a greater need for M.S. graduates in these fields. Recent placements of M.S. and Ph.D. graduates from the FSU MS&E program show that the job-market is strong. Recently, many Ph.D. graduates work for small, high-

tech businesses, with many of them taking leadership roles in those companies working on SBIR/STTR projects. Examples of companies and labs that have employed these graduates are Advanced Conductor Technology, CERN, Enovix, GE, Imprint-Energy, Intel, X-energy, and several national labs. These companies, some of which are small start-up companies, show that materials play a central role in many advanced, new technologies, and MS&E graduates will be readily employed. In a recent survey of FSU MS&E graduates, they said their companies would be interested in hiring FAMU MS&E graduate students.

Creating the MS&E program will also enhance FAMU's ability, along with program faculty in the FAMU-FSU College of Engineering, to increase federal research funding, graduate student recruitment, and doctoral degree production. Over the past decade, federal research awards to interdisciplinary teams in materials areas have increased substantially. Already FAMU faculty associated with this proposal have won substantial NSF grants in materials-related areas and having the FAMU MS&E doctoral degree will provide additional opportunities for major funding from federal agencies.

Bureau of Labor Statistics data show that positions for MS&E graduates will continue to grow and MS&E graduates are well paid. Positions for doctoral-prepared graduates will likely increase, and salaries are expected to be higher for graduates with an advanced degree. The Bureau's data estimate that employment for materials engineers with at least a baccalaureate degree will grow between 3.9% and 12% over the next ten years from 2020 to 2030. The table below shows job growth projected by BLS by occupation aligned with the Materials Science CIP code 40.1001.

Table 1 - Bureau of Labor Statistics

Job Title	Employment Change Percent	Occupational Job Openings	Minimal Education Level	Median Wages
Architectural and Engineering Managers	4.1%	14,700	Bachelor's	$149,530
Materials Engineers	8.4%	1,800	Bachelor's	$95,640
Materials Scientists	3.9%	700	Bachelor's	$99,460
Engineering Teachers, Postsecondary	12.5%	9,300	Doctoral or Professional	$103,600

Growth in the State of Florida is more robust according to the Florida Department of Economic Opportunity. Employment change percent ranges from 11.7% - 14.8% for the years projected from 2021-2029 for the same occupations.

Table 2 - Florida Department of Economic Opportunity

Job Title	Employment Change Percent	Occupational Job Openings	Minimal Education Level	Median Wages
Architectural and Engineering Managers	14.8%	643	Bachelor's	$137,550
Materials Engineers	11.7	44%	Bachelor's	
Materials Scientists	Data Not Available	Data Not Available	Data Not Available	Data Not Available
Engineering Teachers, Postsecondary	Data Not Available	Data Not Available	Data Not Available	Data Not Available

According to O*NET, within the State of Florida, the highest annual median salary for Materials Engineers is in the Palm Bay-Melbourne-Titusville area, as shown in the

accompanying table.

Location	Annual Low (10%)	Annual Q_L (25%)	Annual Median (50%)	Annual Q_U (75%)	Annual High (90%)
United States	$60,580	$76,650	$98,300	$127,110	$161,080
Florida	$48,850	$48,850	$82,070	$126,950	$162,630
Crestview-Fort Walton Beach-Destin, FL	$60,680	$77,500	$99,040	$126,780	$162,410
Jacksonville, FL	$62,360	$77,480	$97,090	$119,770	$123,210
Miami-Fort Lauderdale-West Palm Beach, FL	$59,630	$63,430	$82,310	$113,820	$128,420
Orlando-Kissimmee-Sanford, FL	$60,770	$79,890	$82,530	$122,650	$166,210
Palm Bay-Melbourne-Titusville, FL	$65,080	$91,000	$105,120	$130,720	$163,320

Survey data from O*NET indicates that about 48% new hires need a bachelor's to perform jobs in this occupation, 33% doctoral degree required, and 10% master's degree required. We surmise that with the higher number of positions needed for the doctoral degree, greater numbers of students will seek entry for master's level programs as a path to the doctorate. The graphs below show job postings in positions related to Materials Science and Engineering nationally for 2021.

Table 4 - MS&E Job Postings Requiring Advanced Degree

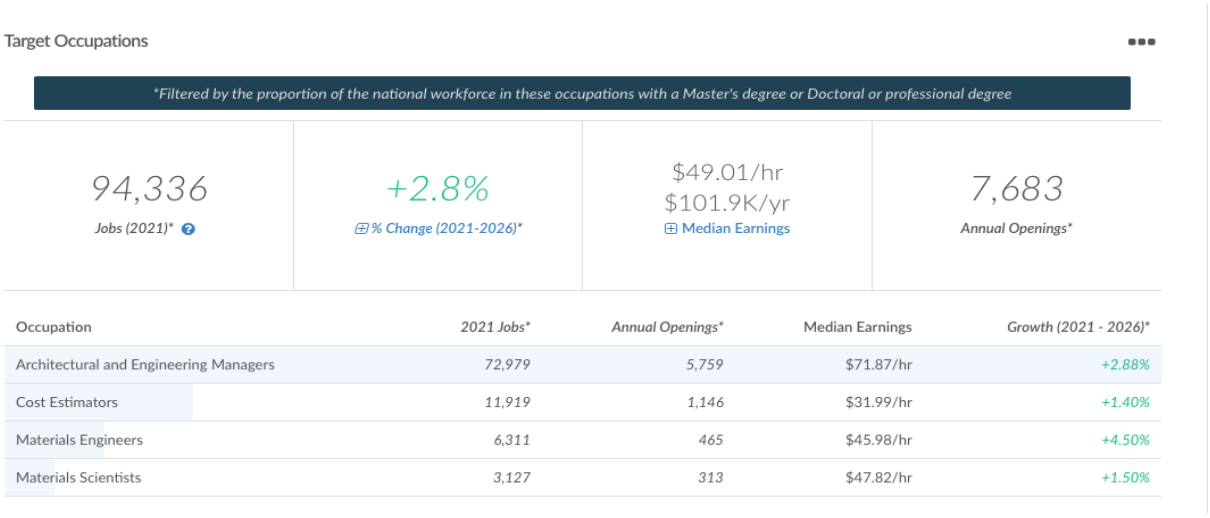
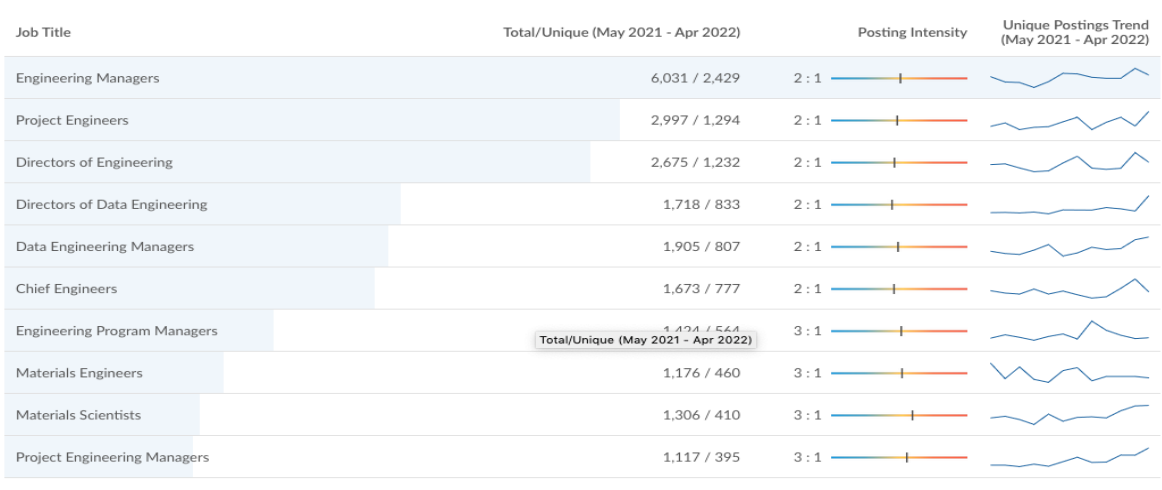


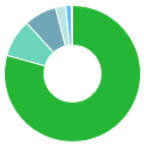
Table 3 - Top Posted Job Titles



Opportunities to close the diversity gap also exist with the proposed program in Materials Science and Engineering offered jointly within the FAMU-FSU College of Engineering. The graph below depicts a breakdown of ethnicity for occupations associated with this discipline. FAMU can contribute to increase the number of minorities prepared for advanced entry into the profession, specifically increased numbers of African American graduates.

Table 5 - MS&E Occupation Race/Ethnicity Breakdown

Occupation Race/Ethnicity Breakdown



Race/Ethnicity	2021 Jobs	2021 Percent
White	350,347	79.3%
Asian	39,565	9.0%
Hispanic or Latino	33,864	7.7%
Black or African American	10,785	2.4%
Two or More Races	5,718	1.3%
American Indian or Alaska Native	1,066	0.2%
Native Hawaiian or Other Pacific Islander	376	0.1%

In addition to Florida industries as sources for occupations, a significant number of companies across the United States are seeking graduates with advanced degrees related to Materials Science and Engineering as evidenced by the graph below.

Table 6 - Total Companies Job Postings

Top Companies Posting Give Feedback

Company	Total/Unique (May 2021 - Apr 2022)	Posting Intensity	Unique Postings Trend (May 2021 - Apr 2022)
Capital One	3,044 / 1,416	2 : 1	
Boeing	2,872 / 1,156	2 : 1	
Raytheon Technologies	1,967 / 826	2 : 1	
Northrop Grumman	2,321 / 718	3 : 1	
Black & Veatch	797 / 623	1 : 1	
General Atomics	1,508 / 579	3 : 1	
Google	1,398 / 447	3 : 1	
L3Harris Technologies	778 / 423	2 : 1	
Facebook	890 / 420	2 : 1	
Apple	726 / 400	2 : 1	

Sources: Bureau of Labor Statistics, U.S. Department of Labor, *Occupational Outlook Handbook*, Materials Engineers, at https://www.bls.gov/ooh/architecture-and-engineering/materials-engineers.htm (visited *September 08, 2021*).

Florida Department of Economic Opportunity and O*NET
https://www.onetonline.org/link/localwages/17-2131.00?st=FL&g=Go (visited October 3, 2021)

B. Provide and describe data that support student demand for the proposed program. Include questions asked, results, and other communications with prospective students.

Materials are used in almost everything we use in our modern society and new developments and advances in materials science underlie improvements in these technologies. For example, when people hear Intel, they think about Intel making the microprocessors that are the brains of computers. The unknown is that Intel is an applied materials science company whose core expertise is taking the drawings of the circuit diagrams for the latest microprocessor and transforming it into a complex 3-D maze of interconnected electronic components that are etched into a tiny chip of silicon that is the microprocessor in your computer. Fabricating microprocessors requires an assortment of materials and chemical processes that Intel is continually modifying and improving to make even faster microprocessors. This example shows where MS&E M.S. graduates are vital to the economy.

Engaging FAMU students in the MS&E Ph.D. program as part of the joint FAMU-FSU College of Engineering where the program already resides at Florida State University will address under-representation of African Americans amongst M.S. Materials Scientists and Engineers and in STEM fields in general. The FAMU-FSU College of Engineering is the #4 producer of PhDs to African Americans of all US engineering schools but cannot yet offer degrees in MS&E to FAMU students.

Several current students in FAMU's NSF CREST (Centers of Research Excellence in Science and Technology – Center for Additive Manufacturing) research center have inquired about when a FAMU MS&E program would be created. They wanted to do their materials-related research in the CREST and earn their graduate degree in MS&E, because this degree would more closely identify their expertise to potential employers, and it would better identify their formal education for the rest of their careers.

Currently, there are thirteen students enrolled in the existing FSU MS&E doctoral program. That number is expected to grow as a result of widening the pool of potential students and placement of the program within the FAMU-FSU College of Engineering.

The College recently surveyed students in other HBCUs that had strong programs that could feed into MS&E, such as chemistry, physics, and undergraduate engineering programs. These surveys were sent to individual faculty members at the HBCUs for the faculty members to forward to the students. FAMU in the FAMU-FSU College of Engineering, chemistry and physics programs were also surveyed. Results are summarized below.

The following questions were asked in the survey with 36 individuals responding.

Table 7 - Please rate your level of interest in a graduate degree in Materials Science and Engineering to be potentially offered at Florida A&M University in the FAMU-FSU College of Engineering?

Very High	High	Somewhat High	Low	Not Interested
27.78% (N=10)	19.44% (N=7)	36.11% (N=13)	13.89% (N=5)	2.78% (N=1)

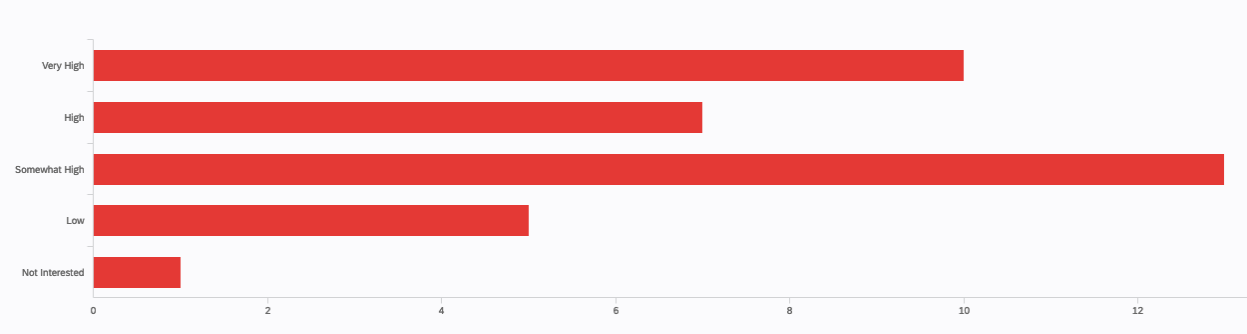


Table 8 - If a graduate degree in Materials Science and Engineering is offered, which level of degree would you likely apply?

Master of Science MS&E	Ph.D. MS&E	Both (completing MS first and then applying to the Ph.D.)
55.56% (N=20)	11.11% (N=4)	33.33% (N=12)

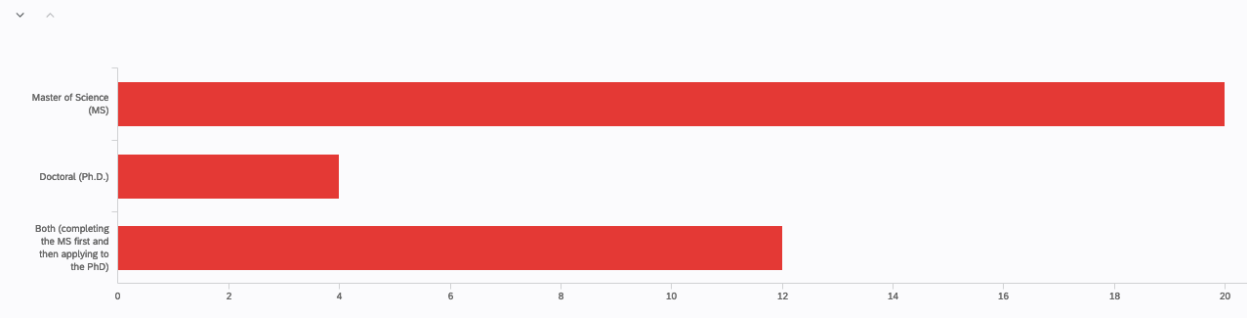


Table 9 - Likelihood of Applying to Master's MSE&E if it were launched in the next 1-2 years.

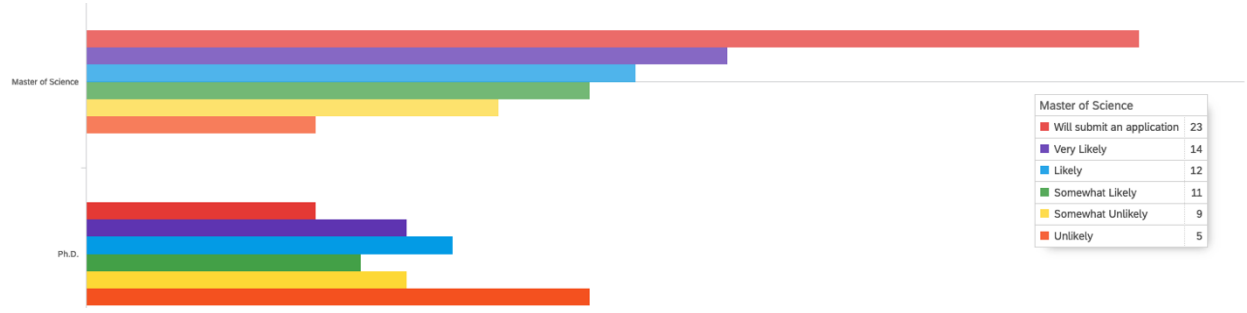


Table 10 - Likelihood of Applying to Ph.D. if launched in the next 1-2 years

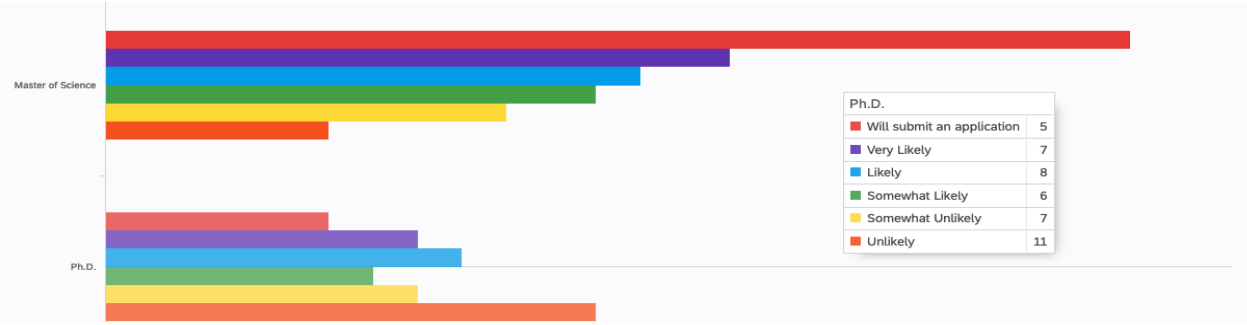
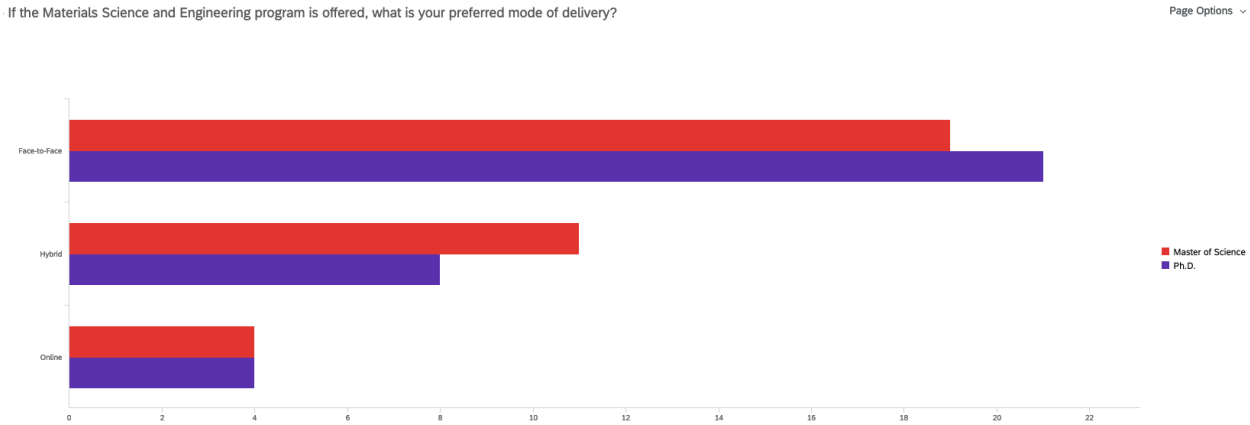


Table 11 - Preferred Mode of Delivery



C. Complete Appendix A – Table 1 (1-A for undergraduate and 1-B for graduate) with projected student headcount (HC) and full-time equivalents (FTE).

- **Undergraduate FTE must be calculated based on 30 credit hours per year**
- **Graduate FTE must be calculated based on 24 credit hours per year**

In the space below, provide an explanation for the enrollment projections. If students within the institution are expected to change academic programs to enroll in the proposed program, describe the anticipated enrollment shifts and impact on enrollment in other programs.

Year One

New students (N=2) for the doctoral program are anticipated from graduates of the FAMU-FSU College of Engineering or related undergraduate programs at FAMU and FSU. After full implementation and development of marketing strategies, the program anticipates growing the program modestly each year until it reaches at least five students by year five. With additional marketing efforts, the program will expand enrollment in the outyears.

Year Two

New students (N=2) for the doctoral program are anticipated from graduates of the FAMU-FSU College of Engineering or related undergraduate programs at FAMU and FSU.

Year Three

In year three, we plan to enroll approximately three (N=3) graduate students for the doctoral degree in Materials Science and Engineering program in year three. The three students are expected to come from comparable undergraduate programs at FAMU and FSU (N=2); undergraduate students from private institutions within the State of Florida, graduates from Florida public universities, or one out-of-state student (N=1).

Year Four

We plan to enroll approximately four (N=4) graduate students for the doctoral degree in Materials Science and Engineering program in year four. The four students are expected to come from comparable undergraduate programs at FAMU and FSU (N=2); undergraduate students from private institutions within the State of Florida, graduates from Florida public universities (N=1), or one out-of-state student (N=1).

Year Five

We plan to enroll approximately five (N=5) graduate students for the doctoral degree in MS&E program in year five. The five students are expected to come from comparable undergraduate programs at FAMU and FSU (N=2); undergraduate students from private institutions within the State of Florida (N=1), graduates from Florida public universities (N=1), or one out-of-state student (N=1).

D. Describe the anticipated benefit of the proposed program to the university, local community, and the state. Benefits of the program should be described both quantitatively and qualitatively.

Numerous reasons exist to offer a joint program in MS&E between FAMU and FSU, particularly as the program already exists within the FAMU-FSU College of Engineering. In 2011, then Provost Harris wrote in her support letter for the FSU MS&E Ph.D. proposal that it would be beneficial for FAMU and FSU to cooperate in MS&E in the future. If implemented, the program will have multiple benefits to FAMU, FSU, the Panhandle region, the State of Florida, and the Nation that includes the following:

- Provide a means to recruit students interested in studying MS&E and create a way to educate and train them to earn an M.S. in a broad, interdisciplinary manner.
- Build on the sizable investments FAMU and FSU have made in start-up packages and infrastructure support for faculty members researching materials-related areas.
- Offer a new STEM program relatively inexpensively.
- Increase FAMU-FSU College of Engineering research visibility.
- Provide increased opportunities for FAMU and FSU to secure greater funding in materials research, particularly large-scale, interdisciplinary grants. Over the past decade, federal research awards to interdisciplinary teams in materials areas have increased substantially.
- Address the critical education need to produce more engineers within the United States and Florida, especially in the areas of materials.
- Contribute to research, economic development, and job creation in the Panhandle region and across the State.

- Increase the Nation's technical capability by attracting and enabling additional research and highly trained researchers for new product development.
- Help address underrepresentation of minorities in STEM disciplines, engineering in particular. The FAMU-FSU College of Engineering has already demonstrated progress in this area by being the number four producer of Ph.D.'s to African Americans of all US engineering schools.

E. If other public or private institutions in Florida have similar programs that exist at the four- or six-digit CIP Code or in other CIP Codes where 60 percent of the coursework is comparable, identify the institution(s) and geographic location(s). Summarize the outcome(s) of communication with appropriate personnel (e.g., department chairs, program coordinators, deans) at those institutions regarding the potential impact on their enrollment and opportunities for possible collaboration in the areas of instruction and research.

Input from the Council of Academic Vice Presidents Coordination Group suggested that demand is available for materials scientists and materials engineers nationally and within the State of Florida. A discussion regarding the addition of a program at FAMU as part of the program offerings within the joint FAMU-FSU College of Engineering was held including a review of enrollment and degree productivity for the last five years (shown below) within the SUS.

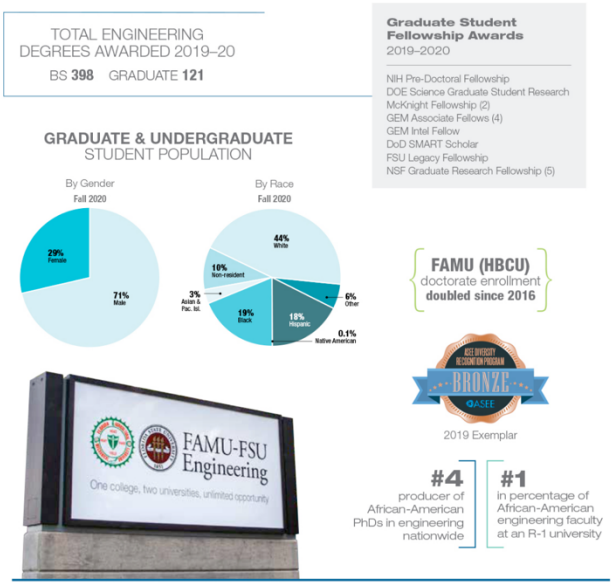
Table 12 - SUS Degree Productivity (Materials Science and Materials Engineering)

Institution	2020	2019	2018	2017	2016	Total by Institution
Florida International University	4	6	5	6	3	**24**
Florida State University	2					**2**
University of Central Florida	2	8	5	15	3	**33**
University of Florida	12	16	20	22	22	**72**
Grand Total	**20**	**30**	**30**	**43**	**28**	**131**

As part of the joint College, collaborations between FAMU and FSU will occur organically. Collaborations with other institutions may also result due to the interdisciplinary nature of the program and research opportunities available to faculty.

F. Describe the process for the recruitment and retention of a diverse student body in the proposed program. If the proposed program substantially duplicates a program at FAMU or FIU, provide a letter of support from the impacted institution(s) addressing how the program will impact the institution's ability to attract students of races different from that which is predominant on the FAMU or FIU campus. The institution's Equal Opportunity Officer shall review this Section of the proposal, sign, and date the additional signatures page to indicate that all requirements of this section have been completed.

In accordance with FAMU's Non-Discriminatory Policy Statement, "each member of the University community is permitted to work or attend class in an environment free from any form of discrimination including race, religion, color, age, disability, sex, sexual harassment, sexual orientation, gender identity, gender expression, marital status, national origin, and veteran status". As an HBCU, FAMU has a population of students that are primarily traditionally underrepresented students. Florida State has a population of majority students and a significant minority representation. As such, the proposed program situated within the joint FAMU-FSU College of Engineering is in a unique position to attract students from various backgrounds, races, and ethnicity as well as center itself to increase gender representation within the STEM disciplines. As evidence of its commitment to diversity, the FAMU-FSU College of Engineering earned a Bronze Award and Exemplar Status from the American Society of Engineering Education (ASEE) in the inaugural year of the ASEE Diversity Recognition Program. The college is one of only two engineering programs in Florida to earn the distinctions.



Initial efforts of the program will be to focus on existing partnerships from member institutions of the Florida-Georgia Louis B. Stokes Alliance for Minority Participation. This Alliance has several member and co-member community colleges and several four-year institutions without graduate programs. Additional recruitment efforts will focus on internal campaigns to recruit highly qualified undergraduate students locally at FAMU and FSU with a specific focus in Chemistry, Physics, and Engineering departments. As this program is one of few offered at HBCUs, FAMU and FSU will join efforts to attract students nationally from other HBCUs across the U.S.

Digital media will be used to advertise the program on FAMU, FSU, and FAMU's NSF-CREST websites. Email campaigns will also be conducted to increase awareness of the program to highly populated enrollment areas for both FAMU and FSU. During the discussion of the proposed program with the Council of Academic Vice Presidents Coordination Group, Florida International University posed no concerns for the addition of the program at FAMU to be delivered collaboratively with FSU as part of the joint FAMU-FSU College of Engineering.

IV. Curriculum

A. Describe all admission standards and all graduation requirements for the program. Hyperlinks to institutional websites may be used to supplement the information provided in this subsection; however, these links may not serve as a standalone response. For graduation requirements, please describe any additional requirements that do not appear in the program of study (e.g., milestones, academic engagement, publication requirements).

MS&E will follow FAMU's admission standards with the following additional requirements.

Admission Criteria for the Ph.D. in MS&E

- An earned bachelor's degree from a regionally accredited U.S. institution, or a comparable degree from an international institution, with a minimum 3.0 (on a 4.0 scale) grade point average (GPA) in all work attempted while registered as an upper-division undergraduate student working towards a bachelor's degree; or
- A graduate degree from a regionally accredited U.S. institution, or a comparable degree from an international institution;
- GRE test scores with the following requirements: Quantitative exam be in the 75th or higher percentile; Verbal exam be in the 55th or higher percentile.
- International students whose first language is not English are required to take an English language exam. Acceptable scores are 80 total on the Internet-based TOEFL examination or 6.5 on the IELTS exam.
- Three (3) letters of recommendation

MS&E specific requirements

- Undergraduate or graduate degree in a STEM field.
- Submit a statement of professional goals
- Three letters of recommendation that assess the student's capabilities to do graduate research.

Graduation Criteria for the Ph.D. in MS&E

- Students must pass a minimum of 54 credits of which a minimum of 27 credits must be letter graded and a minimum of 24 credits must be in Ph.D. research.
- Students must pass all of the required letter-graded coursework with a minimum 3.0 GPA. In addition to meeting the university requirement to maintain an overall GPA of 3.0 or above, MS&E students need to achieve a grade of "B" or better in each core course. Students not achieving a "B" must either retake the course or take another core course in a different topic area that will be selected by MS&E in consultation with the instructor of the core course in which the student did not achieve at least a "B."
- Students must take a written qualifying exam in their second year. This will be based on the required core courses.
- Students must write, present, and defend a written document for their preliminary exam, typically in their third year. This written document is a prospectus that covers the research they have done and their research plans through graduation.

The written document is reviewed by the student's research committee, and the student presents and defends it.

- Students must write a dissertation, which must be an original work and will serve in part to demonstrate the student's ability to carry out research. On completion, the dissertation will be defended orally in front of the dissertation committee.

B. Describe the specific expected student learning outcomes associated with the proposed program and include strategies for assessing the proposed program's learning outcomes. If the proposed program is a baccalaureate degree, include a hyperlink to the published Academic Learning Compact and the document itself as Appendix C.

The specific learning outcomes are:

(1) Ability to demonstrate a thorough knowledge of MS&E: Students graduating with a Ph.D. in MS&E must demonstrate an understanding of a range of topics in MS&E and must also demonstrate the ability to carry out meaningful, independent research.

Assessment Plan: This learning outcome will be assessed by the student performance in the core courses with a written exam, an oral presentation of the research topic with an oral examination (prospectus) of the elective specialization courses and the final oral defense of the dissertation. The evaluation will be based on the following measurements: (1) at least 75% of all students in MS&E will pass the written qualifying exam covering the core courses; (2) at least 80% of the students who pass the qualifying exam will pass their oral preliminary exam; and (3) at least 80% of the students who pass their preliminary exam will pass their dissertation defense.

(2) Ability to present their work in an oral or a poster presentation: Students graduating with a Ph.D. in MS&E will be able to orally communicate their research work to others in the field.

Assessment Plan: This learning outcome will be assessed by the student performance by participation in the MS&E ISS (Interdisciplinary Seminar Series), in the dissertation defense, and oral presentations. The evaluation will be based on the following measurements: (1) at least 80% of the students in the program will pass their preliminary exam, which has an oral component; (2) at least 80% of the students who pass their preliminary exam will pass their dissertation defense; (3) at least 80% of the students will have given an oral presentation of their research in a public forum, preferably at a professional conference in their research area.

(3) Ability to communicate through the written medium. Students graduating with a Ph.D. in MS&E will be able to communicate their work to others in the field through journal articles.

Assessment plan: This learning outcome will be assessed by at least 80% of the students completing a paper and submitting it to a journal or a technical conference before graduating.

(4) Ability to function as an independent scientist/engineer. Students graduating with a Ph.D. in MS&E must demonstrate an ability to function as independent scientists and

engineers, which includes identifying problems in MSE, designing experimental or theoretical methods to address these problems, and performing the corresponding research to solve these problems.

Assessment Plan: This learning outcome will be assessed by the student's performance on the annual Ph.D. evaluations, which includes a research presentation to the student's research committee. At least 80% of the students in the program will have satisfactory annual evaluations.

C. If the proposed program is an AS-to-BS capstone, provide evidence that it adheres to the guidelines approved by the Articulation Coordinating Committee for such programs, as outlined in State Board of Education Rule 6A-10.024. Additionally, please list the prerequisites, if any, and identify the specific AS degrees that may transfer into the proposed program.

☒ **Not applicable to this program because it is not an AS-to-BS Capstone.**

D. Describe the curricular framework for the proposed program, including the following information where applicable:

- **total numbers of semester credit hours for the degree**
- **number of credit hours for each course**
- **required courses, restricted electives, and unrestricted electives**
- **a sequenced course of study for all majors, concentrations, tracks, or areas of emphasis**

The FAMU MS&E program will become an integral part of the existing FSU MS&E program offered in the joint college. The curriculum will be identical for FAMU and FSU students. In the first year, the curriculum will use courses in the existing FSU MS&E curriculum. FAMU students will be able to take FSU courses and FSU students will be able to take FAMU courses through the existing FAMU-FSU cooperative agreement.

Students entering the program with a B.S. degree (or equivalent) will be required to a take a minimum of 54 credits including at least 27 credits of letter-graded courses and at least 24 credits of dissertation research. Students will also take the Interdisciplinary Seminar Series (0 credits) the entire time they are in MS&E. The letter-graded credits are described below.

27 credits (minimum) of letter-graded courses

- Four core courses (minimum 12 credits)
  - Three (3) Fundamental Core Courses: - One course from each of these areas
    - Survey of Materials
    - Thermodynamics
    - Solid state science for materials scientists/engineers
  - One (1) Elective Core Courses: - One course from either of these areas
    - Survey of Synthesis and Processing
    - Characterization of Materials
- Five (5) Elective Specialization Courses (minimum 15 credits)

24 credits (minimum) of dissertation research

Fundamental Core Courses (9 total cr) – Students must take a course in each of the three areas.

Survey of materials – This topic includes an introduction to advanced materials, biomaterials, nanomaterials, and/or topics in materials chemistry, and is covered in several existing courses in mechanical engineering, in chemistry and biochemistry, and in biological science. Incoming MS&E students will have a wide variety of backgrounds. The survey course provides fundamental understanding about materials these students need for the other MS&E courses. This topic area can be taught by faculty members in Chemical Engineering, Chemistry, and Mechanical Engineering. This course deals with the wide variety of basic properties of ceramics, steels, optical, magnetic, and electrical materials.

- *Typically ECH 5934 (3 cr) – Special Topics in Chemical Engineering: Chemical Engineering Materials*

Thermodynamics – This topic concerns the fundamental properties of thermodynamics, as applied to materials science. Existing courses in chemical and biomedical engineering, chemistry, and physics cover this topic. Although each of these courses is based on the same set of fundamental equations, the examples used in each course is based on what is most important for the course's home department. A course dedicated to Thermodynamics for Materials Science has been created for MS&E students. This course deals with energy terms that determine the stability of solid materials and the tendency for reactions to occur.

- *EML 5930 (3 cr) – Special Topics in Mechanical Engineering: Thermodynamics for Materials Science.*

Solid state science for materials scientists/engineers - This topic covers the essential areas of structural, thermal, electronic, and magnetic properties of materials, including superconducting, magnetic, semiconducting, and ferroelectric materials of strong current technological interest. This course is an introduction to a large variety of materials characterization techniques that have been developed and are currently used in materials science research. It also provides the fundamental background in band theory to understand electronic, optical, and magnetic properties of solid materials.

- *PHZ 5475 (3 cr) - Materials Characterization*

Elective Core courses (3 total cr) - Students must take one course from one of the following two areas:

Survey of synthesis and processing. - This topic address the synthesis of materials in bulk, thin film, amorphous, single crystals; morphologies and their transformation into structures for measurement; applications in technology and commercialization. The two courses listed below cover the same basic synthesis topics. EIN 5930 emphasizes a variety of synthesis techniques for a different material systems. EML 5182 focuses on synthesis of composite materials.

- *EIN 5930 3 cr) – Special Topics in Industrial Engineering: Synthesis and Processing of Advanced Materials*
- *EML 5182 (3 cr) – Composite Materials Engineering*

Characterization of materials. - This topic covers materials measurement, including optical, physical, electronic, magnetic, resonant and scattering methods, and microstructural probes. The two courses listed below cover the same basic information about how to characterize materials. The differences are that the main emphasis in EMA 5514 focuses on using electron microscopy to characterize materials, whereas EML 5930 is broader than EMA 5514 and examines several different methods to characterize the microstructures of materials.

- *EMA 5514 (3 cr) – Electron Microscopy*
- *EML 5930 (3 cr) – Special Topics in Mechanical Engineering: Microstructures of Materials*

Interdisciplinary Seminar Series – students take this 0 credit seminar every semester they are in MS&E.

The seminar course will be offered by FAMU and FSU faculty to provide students with an opportunity to obtain information on advances in materials research though presentations by visiting scientists and from FAMU and MS&E faculty. Students will learn and practice presentation skills in this seminar. In addition to technical topics, this seminar series will have talks on business related topics to help prepare the students to take leadership roles as they move from the university setting to industry and society. The seminar will serve as a forum for MS&E faculty members who wish to recruit MS&E students, and so some of these seminar sessions will be set aside to allow multiple faculty members to make short presentations advertising their research programs.

- *ISC 5937 (0 cr) – Interdisciplinary Seminar Series – MS&E*

Elective specialization courses (15 total cr)

These courses are selected by the student and their advisor with the goal of providing the most benefit to the student's research. See Section VIII.E. for a list of these courses.

Suggested course sequence for a student entering MS&E entering in a fall semester. The sequence also shows when other actions, such as selecting an advisor and taking required exams need to be done.

Ph.D.		
------ Year 1 ------		
Fall	**Spring**	**Summer**
• **2 Required Core courses** • **1 Elective Specialization course** • **ISS seminar**	• **1 Required Core course** • **1 Elective Core course** • **1 Elective Specialization course** • **ISS seminar** • **Choose research advisor by end of**	• **Research**

	Spring semester	
------ Year 2 ------		
Fall	**Spring**	**Summer**
• **2 Elective Specialization courses** • **Research** • **ISS seminar** • **Take Ph.D. preliminary exam**	• **1 Elective Specialization course** • **Research** • **ISS seminar**	• **Research**
------ Year 3 ------		
Fall	**Spring**	**Summer**
• **Research** • **ISS seminar** • **Prepare and defend preliminary exam / prospectus**	• **Research** • **ISS seminar**	• **Research**
------ Year 4 ------		
Fall	**Spring**	**Summer**
• **Research** • **ISS seminar**	• **Research** • **ISS seminar**	• **Research**
------ Year 5 ------		
Fall	**Spring**	**Summer**
• **Research** • **ISS seminar**	• **Research** • **ISS seminar** • **Defend Ph.D. dissertation**	• **Graduated**

E. Provide a brief description for each course in the proposed curriculum.

The core courses are described above. The current section is a compilation of elective courses.

- *Chemistry of Materials:* This course introduces materials chemistry, with strong emphasis on the interdisciplinary nature of materials research. The course provides an overview of various classes of materials, including the synthesis and characterization of materials, their structural and physical properties, and how those properties relate to specific applications. (CHM 5715 3 cr)
- *Electrochemistry.* Instrumentation and techniques in electrochemistry, including such topics as electrode processes, potentiometry, voltammertry, and coulometry. (CHM 5153 3 cr).
- *Polymer Chemistry:* The course covers polymers (plastics) which encompass nearly every facet of our daily lives, and the rich variety of properties and functions that characterize these materials, which is deeply seeded in the chemistry and architecture of their macromolecular structure. This course broadly surveys these materials, the current state of the field, and the modern challenges and research opportunities within it. (CHM 5450 3 cr)
- *Characterization of Materials I:* This course deals with microscopic and diffraction methods used for structural characterization of materials, as well as with transport

and magnetic measurements. Recommended for students involved in materials research. (CHM 5716 3 cr)

- *Topics in Materials Chemistry II:* Introduction to materials chemistry, focusing on the structure, properties, and functions of polymers, organic and soft materials, and bio-inspired materials. This course is intended for graduate students involved in materials research. (CHM 5718 3 cr)
- *Chemical and Physical Characterization of Biopolymers*. Course covers biopolymer types and conformations; solution properties of biopolymers; macromolecular equilibria; hydrodynamic behavior; determination of size and shape; biopolymer separations; introduction to biological spectroscopy. (BCH 5745 3 cr).
- *Advanced Polymer Physical Science and Engineering:* This course is a graduate introduction to static and dynamic polymer physics, including models of chains and macroscopic properties. (**ECH 5820** 3 cr)
- *Polymer Science and Engineering.* The course offers graduates fundamental concepts and structure-property relationships of polymeric materials. (ECH 5828 3 cr)
- *Solid State Sensors:* This course covers the fabrication of solid-state sensors, their characterization, operational principles, and applications for acoustic, mechanical, magnetic, radiation, thermal, chemical, and biologic sensors. (EEE 5333 3 cr)
- *Semiconductor Device Theory:* This course covers elementary quantum physics, energy-band theory, carrier properties, theory of p-n junctions, optoelectronics diodes, bipolar junction transistors, and field-effect transistors. **(EEE 6353 3 cr)**
- *Introduction to Energy Storage:* This course provides students with an overview on energy storage technologies and devices with focus on electrochemical storages including advanced rechargeable batteries, electrochemical capacitors, and fuel cells. **(EEL 5075 3 cr)**
- *Photovoltaics:* This course educates students in the design and applications of solar energy technology. This course focuses on theoretical fundamentals of solar energy conversion, types of solar cells and their operations, optical engineering, and energy storage and distribution systems. The course covers solar energy insolation and global energy needs, current trends in photovoltaic energy engineering, solar cell material science, design and installation of solar panels for residential and industrial applications and connections to the national grid and cost analysis of the overall system. (**EEL 5284** 3 cr)
- *Applied Optimization.* The course offers student fundamental of Heuristic Optimization and its applications in engineering design, production and materials research. (ESI 5408 3 cr)
- *Technology Entrepreneurship and Commercialization.* This course provides students with a hands-on educational experience proposing and analyzing technology-based ideas for development as a product and introducing the product into the market. ((EIN 5445 3 cr)
- *Advanced Composite Engineering Topics.* A survey course on advanced composite topics, including fabrication process modeling and simulation, high temperature resins and composites, fiber preform and liquid composite molding (LCM), electrical and EMI shielding properties of composite materials. (EIN 5930 3 cr)

- *Composite Materials Engineering.* This course offers students fundamental knowledge of constitutional materials, interface, fabrication and basic mechanical behaviors of composite materials. (EMA 5182 3 cr)
- *Mechanical Metallurgy.* This course offers students fundamentals of metallurgy. (EMA 5226 3 cr)
- *Materials for Energy Systems.* Introduction to several classes of Materials that are used in systems that produce, store or transfer energy. It concentrates on three main areas in which energy is transformed to useful sources: solar to chemical energy by photocatalysis, nuclear to electric energy by controlled nuclear reactions, and chemical to electrical energy in solid oxide fuel cells. (EML 5930 3 cr)
- *Applied Superconductivity.* This course offers students an introduction to superconductivity, superconducting materials, and the technology challenges related to their processing and application. (EML 5072 3 cr)
- *Continuum Mechanics.* This course offers student fundamentals of continuum mechanics. (EML 5611 3 cr)
- *Introduction to Advanced Materials*: The course provides the fundamentals of the science and practical uses of materials. (EML 5930 3 cr)
- *Computational Physics Laboratory:* This course introduces students to the use of computers to solve computationally intensive problems, including basic instruction in physics problem solving using numerical solutions to differential equations, numerical integration, Monte Carlo, partial differential equations, linear algebra, distributed processing and symbolic algebra. The course also provides instruction in computational techniques and software development skills and practice in using network and software development tools including telnet, ftp, spreadsheets, databases, code management systems, and the World Wide Web. (PHZ 5156 3 cr)
- *Materials Characterization:* This course is an introduction to a large variety of materials characterization techniques that have been developed and are currently used in materials science research. (PHZ 5475 3 cr)
- *Condensed Matter Physics I.* Crystal structure phonons, electron in metals, semiconductors, magnetism, ferroelectrics, and liquid crystals. (PHZ 5491 3 cr)
- *Condensed Matter Physics II.* Elementary excitations in solids, the many-body problem, quantum fluids and superconductivity, magnetism, dielectrics, collective effects in fluids. (PHZ 5492 3 cr)
- *Applied Computational Science I*. This course provides students with high-performance computational tools necessary to investigate problems arising in science and engineering, with an emphasis on combining them to accomplish more complex tasks. A combination of course work and lab work provides the proper blend of theory and practice with problems culled from the applied sciences. Topics include numerical solutions to ODEs and PDEs, data handling, interpolation and approximation, and visualization. (ISC 5315 3 cr)
- *Applied Computational Science II*. This course provides students with high-performance computational tools necessary to investigate problems arising in science and engineering, with an emphasis on combining them to accomplish more complex tasks. A combination of course work and lab work provides the proper blend of theory and practice with problems culled from the applied sciences.

Topics include mesh generation, stochastic methods, basic parallel algorithms and programming, numerical optimization, and nonlinear solvers. (ISC 5316 3 cr)

F. For degree programs in medicine, nursing, and/or allied health sciences, please identify the courses that contain the competencies necessary to meet the requirements identified in Section 1004.08, Florida Statutes. For teacher preparation programs, identify the courses that contain the competencies necessary to meet the requirements outlined in Section 1004.04, Florida Statutes.

☒ **Not applicable to this program because the program is not a medicine, nursing, allied health sciences, or teacher preparation program.**

G. Describe any potential impact on related academic programs or departments, such as an increased need for general education or common prerequisite courses or increased need for required or elective courses outside of the proposed academic program. If the proposed program is a collaborative effort between multiple academic departments, colleges, or schools within the institution, provide letters of support or MOUs from each department, college, or school in Appendix D.

As a graduate program, general education courses are not required. However, because this program is interdisciplinary, departments outside of the FAMU-FSU College of Engineering will participate on both FAMU's and FSU's main campuses. Enrollment in courses for the MS&E program will be shared with students from collaborating disciplines. Increased enrollment in shared courses because of the M.S. in MS&E is expected to have minimal impact on existing courses. The majority of graduate courses have ample enrollment caps of 20-30 students so there is space for MS&E students to enroll in these courses.

H. Identify any established or planned educational sites where the program will be offered or administered. If the proposed program will only be offered or administered at a site(s) other than the main campus, provide a rationale.

This program will be offered as part of the FAMU-FSU College of Engineering located in Tallahassee Florida. Students will take classes on the FAMU main campus, in the FAMU-FSU College of Engineering, and on the FSU main campus. Students will do their research where their advisor has their research labs on the FAMU main campus, in buildings in the FAMU-FSU Collee of Engineering, and in research buildings in Innovation Park (in Tallahassee) including FAMU's Centennial building and the National High Magnetic Field Laboratory.

I. Describe the anticipated mode of delivery for the proposed program (e.g., face-to-face, distance learning, hybrid). If the mode(s) of delivery will require specialized services or additional financial support, please describe the projected costs below and discuss how they are reflected in Appendix A –

Table 3A or 3B.

The courses will be delivered in the traditional face-to-face manner at the FAMU-FSU College of Engineering, FAMU main campus, or on the FSU campus as part of the cooperative agreement between the two universities.

J. Provide a narrative addressing the feasibility of delivering the proposed program through collaboration with other institutions, both public and private. Cite any specific queries made of other institutions with respect to shared courses, distance/distributed learning technologies, and joint-use facilities for research or internships.

The Ph.D. in Materials Science and Engineering will be offered jointly between FAMU and FSU as part of the joint College. No additional institutions will be involved in the course offerings at this time.

K. Describe any currently available sites for internship and/or practicum experiences. Describe any plans to seek additional sites in Years 1 through 5.

☒ Not applicable to this program because the program does not require internships or practicums.

V. Program Quality Indicators - Reviews and Accreditation

A. List all accreditation agencies and learned societies that would be concerned with the proposed program. If the institution intends to seek specialized accreditation for the proposed program, as described in Board of Governors Regulation 3.006, provide a timeline for seeking specialized accreditation. If specialized accreditation will not be sought, please provide an explanation.

Undergraduate programs in MS&E are accredited through ABET, which accredits engineering programs. The FAMU-FSU College of Engineering does not have an undergraduate program in MS&E. There are no accreditation agencies for graduate programs (M.S. or Ph.D.) in Materials Science and Engineering.

B. Identify all internal or external academic program reviews and/or accreditation visits for any degree programs related to the proposed program at the institution, including but not limited to programs within academic unit(s) associated with the proposed degree program. List all recommendations emanating from the reviews and summarize the institution's progress in implementing those recommendations.

The FSU MS&E program, which the FAMU MS&E M.S. program will join, underwent an internal FSU Quality Enhancement Review (QER) in 2018. A summary of the reviewer's comments is provided below, and his full report is in the Appendix.

CURRICULUM

- *Strengths*: Well designed and flexible curriculum; good use of weekly seminar; excellent first-year research rotation
- *Weaknesses*: Core course content is not under control of MS&E program. With the movement of the MS&E programs to the FAMU-FSU College of Engineering, the program director and faculty have increased oversight of the program, including course offerings.

STUDENTS

- *Strengths*: Good numbers of applications; high quality students admitted to program; strong positive student view of program and faculty; strong sense of community among students
- *Weaknesses*: Unpredictability of elective course offerings is a concern for some students; large variation in opportunities for teaching assistantships

FACULTY

- *Strengths*: High quality affiliated faculty with positive international reputations, good external rewards, research support, and publication profiles; cluster hire in materials science (early 2010's)
- *Weaknesses*: There are no faculty appointments dedicated to MS&E

RESOURCES

- *Strengths*: Unique research strengths in the National High Magnetic Field Lab, High Performance Materials Institute, and the Applied Superconductivity Center; excellent laboratory facilities; good access to labs by students and first-year fellowships for research rotations.

- *Weaknesses*: There is no direct source of financial support; administrative support is low if program growth is desired. Dr. Eric Hellstrom serves as the program director for the both the master's and doctoral programs at FSU that now reside within the FAMU-FSU College of Engineering. He will continue in this role with the implementation of the program at FAMU.

C. For all degree programs, discuss how employer-driven or industry-driven competencies were identified and incorporated into the curriculum. Additionally, indicate whether an industry or employer advisory council exists to provide input for curriculum development, student assessment, and academic-force alignment. If an advisory council is not already in place, describe any plans to develop one or other plans to ensure academic-workforce alignment.

The graduate MS&E program does not have an industry advisory council. The Ph.D. is research-oriented and all the Ph.D. graduate students will be supported as research assistants on faculty members' research grants, which are typically funded by a federal agency or industry. To get funding, an MS&E faculty member writes a proposal to a federal agency or industry that addresses a significant scientific problem in some area of materials science and engineering. Proposals are funded that address cutting-edge research in areas that are important to the federal agency or industry. Thus, the MS&E students work on research topics the scientific and technical communities have identified as important, relevant, and timely.

The MS&E doctoral core courses give the students the general background that underpins the discipline of MS&E. Each student takes a different set of elective specialization courses that they choose in consultation with their research advisor to aid with their research. New elective specialization courses relevant for MS&E are being developed at a rate of about one every two to three years. These courses are typically based on topics that are relevant to the faculty member's research who develops the course.

VI. Faculty Participation

A. Use Appendix A – Table 2 to identify existing and anticipated full-time faculty who will participate in the proposed program through Year 5, excluding visiting or adjunct faculty. Include the following information for each faculty member or position in Appendix A – Table 2:

- **the faculty code associated with the source of funding for the position**
- **faculty member's name**
- **highest degree held**
- **academic discipline or specialization**
- **anticipated participation start date in the proposed program**
- **contract status (e.g., tenure, tenure-earning, or multi-year annual [MYA])**
- **contract length in months**
- **percent of annual effort that will support the proposed program (e.g., instruction, advising, supervising)**

This information should be summarized below in narrative form. Additionally, please provide the curriculum vitae (CV) for each identified faculty member in Appendix E.

The table below provides a list of faculty participating in the program and anticipated efforts for years one and five. For this proposal, only information for FAMU faculty is included as the program at FSU has been in existence for more than ten years. However, it should be noted that faculty from the joint College employed at FSU will continue to contribute to the program along with faculty from collaborating departments.

Faculty Code	Name	Highest Degree Held	Academic Discipline or Specialty	Program Start Date	Contract Status	Contract Length	Percent Effort
A	Ali, Jamel	Ph.D.	Chemical and Biomedical Engineering	Spring 2023			5%
A	Arnett, Natalie	Ph.D.	Chemical and Biomedical Engineering/ Chemistry	Spring 2023			5%
A	Dickens, Tarik	Ph.D.	Industrial and Manufacturing Engineering	Spring 2023			5%
A	Johnson, Lewis	Ph.D.	Physics	Fall 2023	Tenured	12-month	5%
A	Kattel, Shyam	Ph.D.	Physics	Fall 2023	Tenure-earning	9-month	5%
A	Ramakrishnan, Subramanian	Ph.D.	Chemical and Biomedical Engineering	Spring 2023			5%
A	Senevirathne, Keerthi	Ph.D.	Chemistry	Fall 2023	Tenured	9-month	5%
A	Thirunavukkuarasu, Komalavalli	Ph.D.	Physics	Fall 2023	Tenure-earning	9-month	5%
A	Weatherford, Physics	Ph.D.	Physics	Fall 2023	Tenured	12-month	5%

B. Provide specific evidence demonstrating that the academic unit(s) associated with the proposed program have been productive in teaching, research, and service. Such evidence may include trends over time for average course load, FTE productivity, student HC in major or service courses, degrees granted, external funding attracted, and other qualitative indicators of excellence (e.g., thesis, dissertation, or research supervision).

Graduate faculty members in the proposed MS Materials Science and Engineering have been productive in teaching, research and grant acquisition. The proposed MS&E is an interdisciplinary program mainly that is independent of any existing academic unit. Faculty that will teach in the MS&E currently teach in related programs in the FAMU-FSU College of Engineering, FAMU Physics, and FAMU Chemistry departments. The departments as a whole have been productive in enrollment, degrees awarded in STEM degrees across engineering, physics, and chemistry. The table below provides a brief synopsis and evidence that FAMU faculty contributing to the program are research active. It shows that from July 2015 through June 2021 they brought in more than $4.12 M in research funding and there are two new grants that start in FY 22 that will bring in another $1.5 M over the next three years.

Name	Department	Professional Publications	Externally-funded research activities – 2015 through 2021[1]
Ali, Jamel	Chemical and Biomedical Engineering	8 Refereed Journal Articles 15 Proceedings	1 @ $79,705 from NSF
Arnett, Natalie	Chemical and Biomedical Engineering/ Chemistry	4 Refereed Journal Articles 15 Proceedings	1 @ $49,999[2] from NSF
Dickens, Tarik	Industrial and Manufacturing Engineering	6 M.S. Theses 1 Ph.D. Dissertation 29 Refereed Journal Articles 5 Proceedings 1 Book Chapter	2 @ $238,996 from NSF and MI Tech U
Johnson, Lewis	Physics	15 Refereed Journal Articles 45 Conference Presentations 4 MS Theses 5 PhD Dissertations	
Kattel, Shyam	Physics	58 Refereed Journal Articles 1 Proceeding	1 @ $2,154,718 from NSF
Ramakrishnan, Subramanian	Chemical and Biomedical Engineering	2 M.S. Theses 3 Ph.D. Dissertation 18 Refereed Journal Articles 2 Book Chapters	5 @ $2,154,718 from NSF

Name	Department	Professional Publications	Externally-funded research activities – 2015 through 2021[1]
Senevirathne, Keerthi	Chemistry	1 M.S. Thesis 4 Refereed Journal Articles	2 @ $150,000 from NSF HBCU and UP
Thirunavukkuarasu, Komalavalli	Physics	11 Refereed Journal articles	4 @ $1,353,323 from DOD and ONR
Weatherford, Charles	Physics	2 M.S. Thesis 3 Ph.D. Dissertations 2 Books 4 Book Chapters 95 Refereed Journal Articles 144 Proceedings	3 @$9.5 million from National Nuclear Security Agency

[1]Funding data are through June 30, 2021.
[2]Arnett has two NSF grants that started in FY 22 that total $1.5 M over the next 3 years.

In addition to research, FAMU collaborating faculty in Physics and Chemistry are active at the graduate level in teaching. Collective graduate enrollment for physics and chemistry are shown below for the last five years.

Table 13 - Graduate Enrollment Chemistry and Physics

	Fall 2017	Fall 2018	Fall 2019	Fall 2020	Fall 2021
Beginning Graduate	12	12	7	8	7
Advanced Graduate	14	15	13	14	10
Total	26	27	20	22	17

VII. Budget

A. Use Appendix A – Table 3A or 3B to provide projected costs and associated funding sources for Year 1 and Year 5 of program operation. In narrative form, describe all projected costs and funding sources for the proposed program(s). Data for Year 1 and Year 5 should reflect snapshots in time rather than cumulative costs.

The budget in Table 3A provides projected costs of the MS&E program and associated funding sources. The total budget for Year One is $90,232. For this proposal, only information for FAMU faculty are included because the FAMU program will become joint with the existing FSU program, which has been in existence for more than ten years. It should be noted that faculty from the joint College employed at FSU will continue to contribute to the program along with faculty from collaborating FSU departments. No additional costs will be incurred on the FSU side from implementing the FAMU program.

Nine full-time faculty are expected to participate in Year One from FAMU from disciplines in engineering, physics, and chemistry. Reallocated dollars from the percent effort of those faculty equate to a total of $50,232. Of the reallocated faculty salaries, approximately $40,647 will be allocated from the Dean's budgets from the FAMU-FSU College of Engineering and College of Science and Technology at FAMU. The remaining dollars of $9585 will come from contracts and grants. By year five, reallocation dollar will be stable at $50,232. However, an increase in assistantship is expected.

It is anticipated that new Ph.D. students will be supported in year one with at least $40,000 dedicated to fellowships. This amount of funding could support at least two full-time Ph.D. students at $20,000 annually. By year five, the goal is to increase the level of support for at least five full-time students at $100,000 collectively until the program reaches its overall target sustainable goal. The funding source for the assistantships will be contracts and grants as students will be supported by faculty research grants. The total cost to the program in year five is $150,232.

B. Use Appendix A – Table 4 to show how existing Education & General (E&G) funds will be reallocated to support the proposed program in Year 1. Describe each funding source identified in Appendix A – Table 4, and provide a justification below for the reallocation of resources. Describe the impact the reallocation of financial resources will have on existing programs, including any possible financial impact of a shift in faculty effort, reallocation of instructional resources, greater use of adjunct faculty and teaching assistants, and explain what steps will be taken to mitigate such impacts.

The overall budget for FAMU's contribution to the FAMU-FSU College of Engineering is $1,034.205. Approximately $22,691 will be reallocated to the Materials Science and Engineering program, leaving a total of $1,011,514.

The overall budget for the FAMU College of Science and Technology is $10.5. Approximately, $27,541 will be reallocated to the Materials Science and Engineering for faculty from chemistry and physics to support the program, leaving a total of $11,483,973.

C. If the institution intends to operate the program through continuing education, seek approval for market tuition rate, or establish a differentiated graduate-level tuition, as described in Board of Governors Regulation 8.002, provide a rationale and a timeline for seeking Board of Governors' approval.

☒ Not applicable to this program because the program will not operate through continuing education, seek approval for market tuition rate, or establish a differentiated graduate-level tuition

D. Provide the expected resident and non-resident tuition rate for the proposed program for both resident and non-resident students. The tuition rates should be reported on a per credit hour basis, unless the institution has received approval for a different tuition structure. If the proposed program will operate as a continuing education program per Board of Governors Regulation 8.002, please describe how the tuition amount was calculated and how it is reflected in Appendix A – Table 3B.

This program will charge graduate tuition rates as shown below.

Fees

Registration and tuition fees are established by the Board of Education and the FAMU Board of Trustees as required by the Florida Legislature. These fees are subject to change without notice. The current credit hour fee schedule is as follows:

	IN-STATE	OUT-OF-STATE
Undergraduate	$151.78	$549.80
Graduate	405.67	1,022.04
Law	455.86	1,097.89

E. Describe external resources, both financial and in-kind support, that are available to support the proposed program, and explain how this amount is reflected in Appendix A – Table 3A or 3B.

A major source of support for students doing the M.S.-thesis is funds for research assistantships paid from faculty members' research grants. The table below shows that the faculty members associated with this proposal are successful raising research funds, which includes support for a graduate student to do research in the faculty member's lab. These grants pay the student's stipend and also pay for in-state tuition. Beyond individual faculty support, the program administrators and faculty will aid students seeking fellowships from organizations such as the Graduate Education for Minorities (GEM) Fellowship Program.

VIII. Non-Faculty Resources

A. Describe library resources currently available to implement and/or sustain the proposed program through Year 5 below, including but not limited to the following:

- **the total number of volumes and serials available in the discipline and related disciplines**
- **all major journals that are available to the university's students**

The Library Director must sign the additional signatures page to indicate that they have review Sections VIII.A. and VIII.B.

Existing library collections in engineering, physics and chemistry are suitable to the materials Science and Engineering program. Library collections contain archival resources, including journal back files, as well as current resources that support a curriculum in Materials Science and Engineering directly and indirectly through interdisciplinary collections in the sciences and technology. Library collections in these disciplines are well balanced and suitable to support all levels of teaching and research including advanced study. The following table shows library holdings in support of Materials Science and Engineering.

The University Libraries provide collections of current books, periodicals, and pertinent reference materials, which have been selected with faculty input and are readily accessible to faculty and students both onsite and off campus. Samuel H. Coleman Memorial Library (the main library) and branch libraries provide traditional print, as well as electronic access to full text databases, e-journals, e-books, and streaming video. Library collections in chemistry, engineering, and physics will support the master's and doctoral degrees in Materials Science and Engineering. The following table shows library holdings in support of Materials Science and Engineering. Lists of pertinent journals and databases are attached.

Books	4,115
Electronic Books	3515
Electronic Journals	156
Electronic databases	38

The University maintains borrowing agreements and memberships that mutually enhance resources availability for FAMU and other Florida learning communities. Partnerships are with the State University Libraries of Florida, the Florida College System Libraries and the State Library of Florida. The Libraries are members of the Florida Virtual Campus (FLVC) which provides the centralized, automated library system used by Florida's 40 public college and university libraries. Florida public postsecondary college and university libraries provide services directly and indirectly to students and faculty of State of Florida postsecondary institutions. Resources held by the other 39 Florida public postsecondary institutions supplement holdings in support of Materials Science and Engineering.

Onsite and reciprocal borrowing privileges to students and faculty at all 40 Florida public institutions of postsecondary education is provided. Service includes daily document delivery via statewide courier among the libraries in the Florida Library Information

Network (FLIN). FAMU students and faculty have access to the courier service for interlibrary loan transactions.

Access to Collections and Services

Students, faculty, and staff have access to collections, resources, and services 24 hours a day, seven days a week, either through the 105 hours that the main library is open or through the library web page. Through the University Libraries' web page, faculty and students have full access to the FAMU library catalog on or off campus, and the library catalogs of the State University System and Florida College System libraries. Online resources and services are available within the libraries, from campus computers, in faculty offices, and from residence halls. Off-campus access is also available 24 hours a day to authenticated users (students, faculty, and staff). Support services such as instruction, interlibrary loans, loan renewals, course reserves, reference assistance, and distance learning services are also accessible from the web page.

Services

FAMU Libraries provide a full range of traditional and innovative library services. Users have access to reference services via local and toll free telephone and through the AskALibrarian electronic mail, online chat, and text services. Services enable users to access and to use information resources in the libraries and from remote locations. The Information Commons, in Coleman Library, allows users to access main library services from one common area. Several Library services are available from this service point. Services include borrowing privileges, interlibrary loan, course reserves, reference and research services, and systems support services.

Borrowing Privileges

Students, faculty, and staff have borrowing privileges at the FAMU Libraries, and reciprocal borrowing privileges to the 40 public universities and colleges in Florida. Borrowers may view and renew items that are currently checked out through the online catalog.

Interlibrary Loan

Students, faculty, and staff who are currently enrolled and engaged in academic research have Interlibrary Loan (ILL) borrowing privileges to the 40 public universities and colleges in Florida and to other libraries globally. Requests may be initiated in person or through the online catalog, which along with reciprocal borrowing and the provision of licensed databases, provides access to materials that the University does not own.

Course Reserves

Print and electronic materials may be placed on reserve at the Libraries. The reserve service provides a central and convenient location for students to retrieve materials. These materials are owned by the University or come from the private collections of faculty members who place materials on reserve for enrolled students.

Reference and Research Services

On site and virtual reference/research services are provided. Reference Services include individual research/consultation, the provision of electronic and print research guides and the provision of online tutorials. Reference librarians provide a variety of instructional services to meet the information literacy needs of students, faculty, staff, administrators, and the community at large.

Instruction/Information Literacy

The University Libraries provide competent, quality, and timely instruction through a variety of instructional services. Information is delivered through informal and point of use instruction, individual and group instruction, formal orientations and literacy sessions, orientation to new student groups, subject specific scheduled workshops, printed handouts, research guides and online tutorials. Instruction is provided to local users as well as to distance learners. Information literacy sessions are designed to equip users with the skills needed to locate, evaluate, and use library information resources and services. Formal literacy instruction is based upon goals as defined by classroom faculty. Information literacy classes provide hands-on interactive instruction. Library instruction is based on the Association of College and Research Libraries (ACRL) Framework for information Literacy for Higher Education.

Liaison Program

Librarians work with all academic units to assure that the collection supports defined curricular goals and that adequate services, including instruction are provided. Each academic program has appointed a representative to serve as library liaison. The representative works in collaboration with the subject librarian to evaluate, select, and purchase resources recommended for academic programs.

Systems Support Services

The Systems Department provides and maintains 250 public computers along with software, hardware, and support services necessary for providing and using information resources. Computers are configured to provide access to the libraries' web page and online catalog. Computers are also configured with various types of production software allowing users' access to the Microsoft Office Suite (Word, Excel, PowerPoint, OneNote, OneDrive), SPSS, SAS, LockDown Browser, and more. Additional services are made available in response to customer service surveys and other assessment.

Computers are located on each floor of the main library and in all branch libraries. Printing is available from all computers. Documents queued to print may be picked up via the closest print station within the main library or any branch library. Scanning stations are available near the Information Commons Desk and provides scanning of photos and documents. Multiple sizes are available.

A help desk is staffed as part of the Information Commons to assist users with software applications and technology support. Helpdesk staff assists users with directional questions, laptop registration and circulation, referrals and resolution of computing and printing needs and issues.

Staff

All Library and related personnel meet or exceed minimal educational requirements as defined by the Association of College and Research Libraries (ACRL). Librarians hold master's degrees from ALA accredited schools. Additionally, two faculty librarians have completed the specialists' degree in library science and three faculty librarians have completed master's degrees in other subject disciplines. The University employs 12 librarians. Support staff are also very well qualified.

Facilities

All faculty and students have full access to the facilities of FAMU's Coleman Memorial Library and branch libraries. These facilities adequately support faculty and student use of information technology for instruction, learning and research. Coleman Memorial Library occupies approximately 88,964 net square feet. Almost 20,000 additional square feet are available in the branch libraries. The University Libraries have a seating capacity of 834, including group study rooms, a student study lounge and cafe, and 20 graduate study carrels. Coleman Library also includes an information literacy classroom and teleconference rooms. All library facilities are wired for internet access. The main library and its immediate grounds are wireless, enabling students and faculty convenient and generous access to the wireless network using their own supported laptops, or they may borrow a network-ready laptop from the Library Systems Department for use in the library.

Pertinent Materials Science and Engineering Journals

- Acta Crystallographica. Section B, Structural Science, Crystal Engineering and Materials
- Advanced Engineering Materials
- Advances in Materials Science and Engineering
- Advances in Materials Science
- Annals of Solid and Structural Mechanics
- Annual Review of Materials Research
- Case Studies in Engineering Failure Analysis
- Chemical Engineering Science
- Colloids and Surfaces. B, Biointerfaces
- Composites. Part A, Applied Science and Manufactures
- Computational Materials Science
- Corrosion Engineering, Science, and Technology
- Engineering Science and Technology
- EPJ Applied Metamaterials.
- Hazardous Waste & Hazardous Materials
- Integrating Materials And Manufacturing Innovation.
- IOP Conference Series. Materials Science And Engineering
- Iranian Journal of Science And Technology, Transactions of Mechanical Engineering
- Journal of Applied Biomaterials & Functional Materials
- Journal of Dynamic Behavior Of Materials
- Journal of Failure Analysis & Prevention
- Journal of Materials.
- Journal of Remanufacturing
- Journal of Renewable Materials
- Materials Science & Engineering. A, Structural Materials
- Materials Science & Engineering. B, Solid-State Materials For Advanced Technology
- Materials Science & Engineering. C, Biomimetic Materials, Sensors And Systems
- Materials Science & Engineering. R, Reports A Review Journal

- Mechanics of Advanced Materials and Structures
- Modelling and Simulation in Materials Science and Engineering
- Nature Reviews. Materials
- Nuclear Materials and Energy
- Progress in Additive Manufacturing
- Research Letters in Materials Science
- Soft Materials

Materials Science and Engineering Databases

- Access Engineering
- ACM Digital Library
- ACS Journals
- Aluminum Industry Abstracts
- American Chemical Society Journals (ACS)
- American Society of Civil Engineering Database (ASCE)
- AIP
- Ceramic Abstracts
- Civil Engineering Abstracts
- Compendex
- Engineering Village
- Engineered Material Abstracts
- Engineering Village
- Environmental Engineering Abstracts
- IEEE Xplore
- Inspec
- Engineering Village
- IOP Electronic Journals
- Materials Business File
- Materials Research Database
- Mechanical & Transportation Engineering Abstracts
- Mechanical Engineering Abstracts
- Solid State & Superconductivity Abstracts
- Sustainability Science Abstracts
- ANTE: Abstracts in New Technology and Engineering
- Applied Science & Technology Source
- Earthquake Engineering Abstracts
- Engineering Collection
- Proquest Engineering Research Database
- ScienceDirect
- SciFinder
- SpringerLink
- Taylor & Francis
- Wiley Online Library

B. Discuss any additional library resources that are needed to implement and/or sustain the program through Year 5. Describe how those costs are reflected in Appendix A – Table 3A or 3B.

☒ Not applicable to this program because no additional library resources are needed to implement or sustain the proposed program.

C. Describe any specialized equipment and space currently available to

implement and/or sustain the proposed program through Year 5.

Each of the faculty members already has the specialized research equipment in their research laboratory needed to carry out high-quality research. Often this was purchased as part of a new faculty member's startup package. The faculty members also have access to shared equipment within their department. In addition, faculty members associated with the High-Performance Materials Institute and the National High Magnetic Field Laboratory, which are located in Innovation Park adjacent to the FAMU-FSU College of Engineering, have access to shared equipment in these two research facilities.

- KLA iNano
- Nanoscience Scanning Electron Microscopy (SEM)
- Laser nScrypt 3Dn-300 nScrypt 3Dn-450
- Meltio M450
- MTS 858 test machine
- NozTek extruder
- Thinky Planetary Mixer
- Hot presses (6"x6", 12"x12" and 24"x24")
- Thermogravimetric Analyzer, TGA Q50, TA Instrument
- HDR TA Instrument
- Anton Paar MCR 302 Rheometer - Qty 2
- TA instruments Differential Scanning Calorimeter (DSC)
- Brookhaven Instruments Dynamic Light Scattering
- Wyatt Instruments Static and Dynamic Light Scattering (Multi Angle)
- Wyatt Instruments Laser Light Scattering Viscometric Detector
- Wyatt Instruments Differential Refractometer
- Wyatt Instruments Laser Light Scattering Zeta Potential Machine (Mobius)
- Agilent 1200 High Performance Liquid Chromatography with UV Vis detector
- LS Instruments Diffusing Wave Spectroscopy
- 8 Glove Glovebox
- Qsense E4 Quartz Crystal Microbalance
- Beckman Coulter Benchtop Centrifuge
- nScrypt 3Dn-300 BAT bioprinter
- Optical Microscope
- Schlenk Line/Fume Hood
- Nikon Eclipse Ti2
- Prime 95b sCMOS Camera for microscope
- MagnebotiX AG MFG-100 System
- Azur Light Systems 5W
- 1064nm single-frequency laser
- Acousto-optical deflector system
- Excella E-25 Incubated Shaker
- Labconco Purifier® Logic®+ Class II A2 Biosafety Cabinets (4' and 5')
- Accu-jet Pro Pipet Controllers
- Stirring Hotplates
- Analytical Balance
- Kepco BOP 100-2DL802E 200 W Bipolar Power Supplies
- National Instruments NI PCIe-6363
- X Series DAQ
- Qsonica 700-Watt sonicator system
- ThorLabs Nexus Optical Table (4' x 8')
- VWR CO2 Incubator
- VWR -80C Freezer Chest
- Thermo Scientific Orion Star A211 pH Benchtop Meter
- VWR Standard Heavy-Duty Vortex Mixer
- PURELAB flex Water Purification System

- VWR Standard Series Refrigerators and Freezer
- GentleMACS™ dissociator
- Beckman Coulter Avanti JXN-30 Floor Centrifuge
- Beckman Coulter Allegra® X-14 Series Benchtop Centrifuge
- Eppendorf 5425 Centrifuge
- Nanodrop OneC Spectrophotometer
- SunP Biotech 3D BIOMAKER Bioprinter
- Cell Link INKREDIBLE+ Bioprinter
- Anton Paar MCR 302 Rheometer
- Broadband Fourier Transform Infrared Spectrometer (Bruker vertex 70v)
- Optical microscope cryostat (Cryo Industries)
- Diamond anvil cells
- Nitrogen-purged glove box (Vacuum Technology Inc.)
- Computer-controlled micromanipulator
- Photoluminescence setup (HR 4000 Ocean Optics).
- High voltage electrospinning setup
- Shimadzu GC-8A Gas chromatograph
- Photocatalytic testing setup including a Newport Xenon lamp & power supply
- WaveDriver 10 Potentiostat Bundle with Rotating Disk Electrodes
- Schlenk lines
- Tube and box furnaces
- Fume hoods
- Wet-chemistry stations
- Local Workstation computers (two 8 cores HP workstation and one 32 core HP workstation)

Software licenses * Vienna Ab-Initio Simulation Package (VASP) * Material Studio * Materials Design

D. Describe any additional specialized equipment or space that will be needed to implement and/or sustain the proposed program through Year 5. Include any projected Instruction and Research (I&R) costs of additional space in Appendix A – Table 3A or 3B. Costs for new construction should be provided in response to Section X.E. below.

☒ Not applicable to this program because no new I&R costs are needed to implement or sustain the program through Year 5

E. If a new capital expenditure for instructional or research space is required, indicate where this item appears on the university's fixed capital outlay priority list. Appendix A – Table 3A or 3B includes only I&R costs. If non-I&R costs, such as indirect costs affecting libraries and student services, are expected to increase as a result of the program, describe and estimate those expenses in narrative form below. It is expected that high enrollment programs, in particular, would necessitate increased costs in non-I&R activities.

☒ Not applicable to this program because no new capital expenditures are needed to implement or sustain the program through Year 5.

F. Describe any additional special categories of resources needed to operate the

proposed program through Year 5, such as access to proprietary research facilities, specialized services, or extended travel, and explain how those projected costs of special resources are reflected in Appendix A – Table 3A or 3B.

☒ Not applicable to this program because no additional special categories of resources are needed to implement or sustain the program through Year 5.

G. Describe fellowships, scholarships, and graduate assistantships to be allocated to the proposed program through Year 5, and explain how those are reflected in Appendix A – Table 3A or 3B.

☐ Not applicable to this program because no fellowships, scholarships and/or graduate assistantships will be allocated to the proposed program through Year 5.

The program anticipates adding two graduate research assistantships each year. Each assistantship is estimated at $20,000 for a total of $40,000 in years one through five. The students who receive these assistantships will do three 10-week-long rotations in faculty member's research labs to find a good fit between the student, their research interests, and a faculty member's research and funding. At the beginning of their first summer, these students are expected to move to a faculty member's research groups where they will be supported from research grants for the remainder of their time as a graduate student.

IX. Required Appendices

The appendices listed in tables 1 & 2 below are required for all proposed degree programs except where specifically noted. Institutions should check the appropriate box to indicate if a particular appendix is included to ensure all program-specific requirements are met. Institutions may provide additional appendices to supplement the information provided in the proposal and list them in Table 4 below.

Table 1. Required Appendices by Degree Level

Appendix	Appendix Title	Supplemental Instructions	Included? Yes/No	Required for Degree Program Level		
				Bachelors	Masters/ Specialist	Doctoral/ Professional
A	Tables 1-4		x	X	X	X
B	Consultant's Report and Institutional Response					X
C	Academic Learning Compacts	Include a copy of the approved or proposed Academic Learning Compacts for the program	Not Applicable	X		
D	Letters of Support or MOU from Other Academic Units	Required only for programs offered in collaboration with multiple academic units within the institution	Forthcoming	X	X	X
E	Faculty Curriculum Vitae		X	X	X	X
F	Common Prerequisite Request Form	This form should also be emailed directly to the BOG Director of Articulation prior to submitting the program proposal to the Board office for review.	Not Applicable	X		
G	Request for Exemption to the 120 Credit Hour Requirement	Required only for baccalaureate degree programs seeking approval to exceed the 120 credit hour requirement	Not Applicable	X		
H	Request for Limited Access Status	Required only for baccalaureate degree programs seeking approval for limited access status	Not Applicable	X		

Table 2. Additional Appendices

Appendix	Appendix Title	Description
I	FAMU Provost Letter to FSU	Letter of Support for FSU MS&E

APPENDIX A

TABLE 1-B

PROJECTED HEADCOUNT FROM POTENTIAL SOURCES

(Graduate Degree Program)

Source of Students (Non-duplicated headcount in any given year)*	Year 1 HC	Year 1 FTE	Year 2 HC	Year 2 FTE	Year 3 HC	Year 3 FTE	Year 4 HC	Year 4 FTE	Year 5 HC	Year 5 FTE
Individuals drawn from agencies/industries in your service area (e.g., older returning students)	0	0	0	0	0	0	0	0	0	0
Students who transfer from other graduate programs within the university**	0	0	0	0	0	0	0	0	0	0
Individuals who have recently graduated from preceding degree programs at this university	2	2	2	2	2	2	2	2	2	2
Individuals who graduated from preceding degree programs at other Florida public universities	0	0	0	0	1	1	1	1	1	1
Individuals who graduated from preceding degree programs at non-public Florida institutions	0	0	0	0	0	0	0	0	0	0
Additional in-state residents***	0	0	0	0	0	0	0	0	0	0
Additional out-of-state residents***	0	0	0	0	0	0	1	1	1	1
Additional foreign residents***	0	0	0	0	0	0	0	0	1	1
Other (Explain)***	0	0	0	0	0	0	0	0	0	0
Totals	**2**	**2**	**2**	**2**	**3**	**3**	**4**	**4**	**5**	**5**

* List projected annual headcount of students enrolled in the degree program. List projected yearly cumulative ENROLLMENTS instead of admissions.

** If numbers appear in this category, they should go DOWN in later years.

*** Do not include individuals counted in any PRIOR category in a given COLUMN.

APPENDIX A

Table 2

Anticipated Faculty Participation

Faculty Code	Faculty Name or "New Hire" Highest Degree Held Academic Discipline or Specialty	Rank	Contract Status	Initial Date for Participation in Program	Mos. Contract Year 1	FTE Year 1	% Effort for Prg. Year 1	PY Year 1	Mos. Contract Year 5	FTE Year 5	% Effort for Prg. Year 5	PY Year 5
A	Jamel Ali, Ph.D. Chemical and Biomedical Engineering			Spring 2023	9	0.75	0.05	0.04	9	0.75	0.05	0.04
A	Natalie Arnett, Ph.D. Chemical and Biomedical Engineering and Chemistry			Spring 2023	9	0.75	0.05	0.04	9	0.75	0.05	0.04
A	Tarik Dickens, Ph.D. Industrial and Manufacturing Engineering			Spring 2023	9	0.75	0.05	0.04	9	0.75	0.05	0.04
A	Lewis Johnson, Ph.D. Physics		Tenured	Fall 2023	12	1.00	0.05	0.05	12	1.00	0.05	0.05
A	Shyam Kattel, Ph.D. Physics		earning	Fall 2023	9	0.75	0.05	0.04	9	0.75	0.05	0.04
A	Subramanian Ramakrishnan Chemical and Biomedical Engineering			Spring 2023	9	0.75	0.05	0.04	9	0.75	0.05	0.04
A	Keerthi Senvirathne Physics		Tenured	Fall 2023	9	0.75	0.05	0.04	9	0.75	0.05	0.04
A	Komalavalli Thirunavukkuarasu Physics		Tenure-earning	Fall 2023	9	0.75	0.05	0.04	9	0.75	0.05	0.04
D	Charles Weatherford Physics		Tenured	Fall 2023	12	1.00	0.05	0.05	9	0.75	0.05	0.04
	Total Person-Years (PY)							**0.31**				**0.31**

Faculty Code	Code Description	Source of Funding	PY Workload by Budget Classification Year 1		Year 5
A	Existing faculty on a regular line	Current Education & General Revenue	0.26		0.26
B	New faculty to be hired on a vacant line	Current Education & General Revenue	0.00		0.00
C	New faculty to be hired on a new line	New Education & General Revenue	0.00		0.00

APPENDIX A

Table 2

Anticipated Faculty Participation

D	Existing faculty hired on contracts/grants	Contracts/Grants	0.05		0.05
E	New faculty to be hired on contracts/grants	Contracts/Grants	0.00		0.00
F	Existing faculty on endowed lines	Philanthropy & Endowments	0.00		0.00
G	New faculty on endowed lines	Philanthropy & Endowments	0.00		0.00
H	Existing or new faculty teaching outside of regular/tenure-track line course load	Enterprise Auxiliary Funds	0.00		0.00
		Overall Totals for	**0.31**		**0.31**

APPENDIX A

TABLE 3A

EROLLMENT AND GROWTH

PROJECTED COSTS AND FUNDING SOURCES

Institutions should not edit the categories or budget lines in the table below. This table is specific to state-funded (E&G) programs, and institutions are expected to explain all costs and funding sources in Section VII.A. of the proposal. Detailed definitions for each funding category are located at the bottom of the table.

Budget Line Item	Reallocated Base* (E&G) Year 1	Enrollment Growth (E&G) Year 1	New Recurring (E&G) Year 1	New Non-Recurring (E&G) Year 1	Contracts & Grants (C&G) Year 1	Philanthropy/ Endowments Year 1	Other Funding Year 1 - Please Explain in Section VII.A. of the Proposal	**Subtotal Year 1**	Continuing Base** (E&G) Year 5	New Enrollment Growth (E&G) Year 5	Other*** (E&G) Year 5	Contracts & Grants (C&G) Year 5	Philanthropy/ Endowments Year 5	Other Funding Year 5 - Please Explain in Section VII.A. of the Proposal	**Subtotal Year 5**
Salaries and Benefits (Faculty)	40,647	0	0	0	9,585	0	0	**$50,232**	40,647	0	0	9,585	0	0	**$50,232**
Salaries and Benefits (A&P and USPS)	0	0	0	0	0	0	0	**$0**	0	0	0	0	0	0	**$0**
OPS (including assistantships & fellowships)	0	0	0	0	40,000	0	0	**$40,000**	0	0	0	100,000	0	0	**$100,000**
Programmatic Expenses****	0	0	0	0	0	0	0	**$0**	0	0	0	0	0	0	**$0**
Total Costs	**$40,647**	**$0**	**$0**	**$0**	**$49,585**	**$0**	**$0**	**$90,232**	**$40,647**	**$0**	**$0**	**$109,585**	**$0**	**$0**	**$150,232**

*Identify reallocation sources in Table 4.

**Includes recurring E&G funded costs ("reallocated base," "enrollment growth," and "new recurring") from Years 1-4 that continue into Year 5.

***Identify if non-recurring.

****include library costs, expenses, OCO, special categories, etc.

Faculty and Staff Summary

Total Positions	Year 1	Year 5
Faculty (person-years)	0.31	0.31
FTE (A&P and USPS)	0	0

Calculated Cost per Student FTE

	Year 1	Year 5
Total E&G Funding	$40,647	$40,647
Annual Student FTE	2	5
E&G Cost per FTE	20323.43125	8129.4

Table 3 Column Explanations

Reallocated Base* (E&G)	1	E&G funds that are already available in the university's budget and will be reallocated to support the new program. Please include these funds in the Table 4 – Anticipated reallocation of E&G funds and indicate their source.
Enrollment Growth (E&G)	2	Additional E&G funds allocated from the "Student and Other fees Tust Fund" contingent on enrollment increases.
New Recurring (E&G)	3	Recurring funds appropriated by the Legislature to support implementation of the program.
New Non-Recurring (E&G)	4	Non-recurring funds appropriated by the Legislature to support implementation of the program. Please provide an explanation of the source of these funds in the budget section (section VII.A.) of the proposal. These funds can include initial investments, such as infrastructure.
Contracts & Grants (C&G)	5	Contracts and grants funding available for the program.
Philanthropy Endowments	6	Funds provided through the foundation or other Direct Support Organizations (DSO) to support the program.
Continuing Base** (E&G)	7	Includes the sum of columns 1, 2, and 3 over time.
New Enrollment Growth (E&G)	8	See explanation provided for column 2.
Other*** (E&G)	9	These are specific funds provided by the Legislature to support implementation of the program.
Contracts & Grants (C&G)	10	See explanation provided for column 5.
Philanthropy Endowments	11	See explanation provided for column 6.
Other Funding	12	Any funding sources not already covered in any other column of the table. Please provide an explanation for any funds listed in these columns in the narrative for Section VII.A. of the proposal.

APPENDIX A

TABLE 4

ANTICIPATED REALLOCATION OF EDUCATION GENERAL FUNDS*

Program and/or E&G account from which current funds will be reallocated during Year 1	Base before reallocation	Amount to be reallocated	Base after reallocation
FAMU-FSU College of Engineering	1,034,205	22,691	**$1,011,514**
College of Science and Technology	10,500,000	27,541	**$10,472,459**
	0	0	**$0**
	0	0	**$0**
	0	0	**$0**
	0	0	**$0**
	0	0	**$0**
	0	0	**$0**
Totals	$11,534,205	$50,232	**$11,483,973**

*** If not reallocating E&G funds, please submit a zeroed Table 4**

EXTERNAL REVIEWER REPORT

MATERIALS SCIENCE AND ENGINEERING QER

October 4-5, 2018

Dr. William H. Warnes, Oregon State University

INTRODUCTORY COMMENTS

The following report summarizes the two day external review of the Materials Science and Engineering (MS&E) Graduate Program at Florida State University. The review was conducted by Dr. William Warnes on October 4 and 5, 2018 as part of the FSU Quality Enhancement Review process.

It is important to know from the outset that the MS&E graduate degree program is unusual in the following ways:

1) It is a graduate program without a correlated department. As such, the program holds no faculty appointments and has no control over courses. All affiliated faculty have tenure homes in member departments, not in the MS&E program;
2) The interdisciplinary program is the only graduate degree under the FSU Graduate School, with the Director reporting directly to the Graduate Dean;
3) The students matriculating in the MS&E program conduct their thesis research under the guidance of faculty advisors in the member departments, and thus are performing research essential to the productivity of the departmental tenure home of their faculty advisor, in spite of earning a degree in MS&E.

These features distinguish the interdisciplinary graduate degree program from most other discipline specific degrees at the University. They provide both desirable features for the students and faculty in the program, as well as opportunities and difficulties for administration within the "normal" University structure.

This non-departmental structure is fairly common across the U.S. for interdisciplinary programs within the Science and Engineering arena (N.B. programs such as Materials Science and Bioengineering are often in this circumstance), and most other Universities struggle with the best way to support such programs.

This review report focuses primarily on the PhD program, since the MS degree has been strongly de-emphasized by the MS&E program and faculty since the establishment of the PhD program in 2011.

CURRICULUM

Strengths: Well designed and flexible curriculum; good use of weekly seminar; excellent first-year research rotation

Weaknesses: Core course content is not under control of MS&E program

The current curriculum was established at the formation of the program (2008) and consists of three required core courses, one elective core course (chosen from a limited list of six graduate courses), and 4 (for the M.S.) or 5 (for the Ph.D.) elective courses chosen from a larger list of graduate courses.

The design of the curriculum is good, and consistent with the national and international norms for MS&E. The flexibility demonstrated in the elective courses provides significant opportunity for the student and faculty advisor to fine-tune the course of study for the individual student. This provides the best instructional support for the thesis research and the student interests, and is a significant strength of the program.

Two more strengths of the curriculum are the weekly seminar and the first-year fellowship research rotation program. The seminar is required each semester (0 credits) and is well attended by the students. It clearly provides good exposure to the interdisciplinary topics, allows for social interaction and community building among the students (who can become spread out through the various member departments), gives a platform for practice of professional presentation skills in a safe and supportive environment, and maintains contacts among the students for access to research labs and capabilities across campus. The research rotation allows each student opportunities to sample several research areas before settling on a faculty advisor and thesis area. It also gives faculty a chance to "try out" a student for a ten-week period before committing to on-going support through research contracts or as a teaching assistant. The rotation requires a considerable amount of effort to manage but has significant benefits for both the student and the faculty.

The required courses are those needed for a graduate degree in MS&E. A significant difficulty for the program is that none of the courses in the curriculum are under the direct control of the program. Each course, including the required core courses, is offered by member departments. The difficulty arises when the course content is changed to support the needs of the offering department rather than containing the content needed by MS&E students. This is clearly a problem, and was raised as a concern by both students and faculty during the review.

An illustrative example of this is the required core course *Materials Thermodynamics and Kinetics* (ECH5934), offered by the Chemical Engineering Department. Sometime within the past two years, Chemical Engineering decided to change the topic coverage of the course to focus on thermodynamics of chemical processing systems (rather than solid systems) and reduce kinetics coverage to only a few lectures. (N.B. the current course description is "a detailed study of some topic of special interest to chemical engineers".) This has left the MS&E students without a graduate exposure to either materials thermodynamics or kinetics (time dependent processes), which are critical topics for an MS&E graduate.

Several other examples of the difficulties in the MS&E curriculum without program control over course content are described in the MS&E self-study report.

Possible Solutions for Weaknesses: Assigning three courses each year to the MS&E program to "buy-out" the teaching of faculty from their departmental teaching responsibilities would

allow the MS&E program to regain control over the course content in the most critical courses. This could be a re-assignment of teaching resources from departments, or a new budget item supported through the Graduate School. These courses ***must be taught*** even though the current numbers of students who are required to enroll in them will initially be small (5-8 new MS&E students each year.)

STUDENTS

Strengths: Good numbers of applications; high quality students admitted to program; strong positive student view of program and faculty; strong sense of community among students
Weaknesses: Unpredictability of elective course offerings is a concern for some students; large variation in opportunities for teaching assistantships

In the interviews with the MS&E graduate students (more than 15 students over the two days) it was clear that the students have strongly positive experiences with the faculty, the other graduate students in the program, and the overall design of the graduate curriculum. Of particular importance to the students was the accessibility and openness of the faculty, the support for and access to research equipment needed for thesis work (across the University), the flexibility of the graduate curriculum, and especially the value of the first-year research rotation.

Of specific concern to the students was the content of the required core courses, as mentioned in the curriculum section above. The uncertainty of the timing of elective course offerings made it difficult for some students to do longer range planning. As well, several students indicated that they were unclear about the graduation requirements and timelines for filing university paperwork. In part this last concern is due to the differences in requirements between the MS&E program and the requirements of the home departments of the faculty advisor. Most students felt that the timeline/requirements were not issues because there was someone they could go to with questions (either the Director or Judy Gardner, the staff person for the program) and get quick definitive answers.

A point of anxiety for some students is the process of obtaining support from a faculty member after the first-year fellowship concludes. Several students commented that some faculty are reluctant to commit to research assistant support, and some faculty are forbidden to offer MS&E students teaching assistant support. These concerns expressed by the students were validated during discussions with faculty. Faculty in some member departments are strongly discouraged from supporting MS&E students on research appointments since these degrees "will not count" toward the productivity of the department (and may not be accepted as faculty productivity for those going through promotion and tenure.) In addition, some departments restrict available teaching assistant support to students with a degree in the departmental program. This limitation on teaching assistantships leave the faculty member completely reliant on research support for MS&E students and prevents the use of teaching assistantships as a "safety net" when there is a lapse in research funding. The lack of a safety net for the MS&E students strongly biases some faculty against supporting an MS&E student. The departments of Chemistry, Physics, and Industrial Engineering were identified by both students and faculty in this context. Issues such as this are common among interdisciplinary graduate programs nationwide. Lacking a home department, it is difficult for programs such as these to operate and

prosper within the rigid structures and rules that govern the promotion/tenure and budgeting processes.

As a side note, discussions with faculty revealed that support levels for graduate students are quite variable across the member departments. Individual departments seem to have different levels of support from one another, and there are differences in how support is determined. The graduate students did not express concern over the support levels or the variation between them, indicating that the support is reasonable in comparison with the cost of living in Tallahassee. If this variability continues and the program grows in size, students will become aware of the differences in support among departments, which could affect their decisions about what research to pursue for the thesis.

Review of the graduation times and the degree process shows that students are graduating within reasonable times (4.6 years on average), and the qualifier and preliminary exam process provides good feedback for both students and faculty on student degree progress and expectations.

Reviewing the application and matriculation data it is apparent that the program attracts a good variety of high quality applicants from both domestic and international sources. The small number of admissions each year (7 average) allows for a very selective process, and the first-year fellowships provide an excellent incentive to attract students to the program. The program could admit more students easily if more fellowship support were available. The current student body is diverse in gender (~40% female), and country of origin (~70% nonresident alien). Domestic ethnic diversity could be better (100% white), but is limited by the application pool (74% white) and admitted students who choose to matriculate to the program.

Post-graduation placement data is very good, with nearly 100% placement of students in National Laboratories, private companies, or university positions.

Possible Solutions for Weaknesses: Providing some University level guidance on the use of graduate teaching assistantships could help make the process more uniform among member departments. Allowing any graduate student with the appropriate background to apply to be a teaching assistant, regardless of their proposed major, would provide a more equitable platform for providing teaching assistantship opportunities, especially within interdisciplinary programs such as MS&E. Creating a safety-net fund for faculty with MS&E students on research appointments who lose funding, would significantly improve the confidence of the faculty to appoint MS&E students, even when their home department will not provide teaching assistantships to these students.

FACULTY

Strengths: High quality affiliated faculty with positive international reputations, good external rewards, research support, and publication profiles; cluster hire in materials science (early 2010's)

Weaknesses: There are no faculty appointments dedicated to MS&E

Faculty affiliated with the MS&E program are of high quality, with good international reputations, strong records of research funding and scholarly publications. Because the MS&E program does not have an academic departmental home, there are no faculty (other than the

part-time Director) who are part of the MS&E program. There is no direct control of faculty lines in the budget for hiring within MS&E. Therefore, the program relies on the generosity of member departments to hire faculty with a focus on materials research.

In the early 2010's, FSU set out to intentionally hire a group of faculty with a specific focus on materials related research. These faculty, about 14 faculty at present, have provided a strong basis for the establishment of the PhD program, and have their tenure homes in a variety of MS&E member departments (Physics, Chemistry, Chemical Engineering, Scientific Computing, Industrial Engineering, and Mechanical Engineering.) These recent hires constitute about half of the affiliated faculty for the MS&E program.

Because all faculty have tenure homes in specific departments, there is no mandated commitment to the MS&E graduate program beyond personal interest from individual faculty. This weakens the ability of faculty to support MS&E (especially new un-tenured faculty) with specialized coursework or graduate student financial support. While volunteerism among the faculty has been partially successful so far, future materials related hires of faculty will not strengthen the MS&E program without addressing the disconnect between MS&E program responsibilities and departmental responsibilities. Hiring faculty with the expectation of being part of the MS&E program and then not enabling their participation through graduate student support and teaching assignments is unfair to the incoming faculty hired as part of a materials science initiative. If it continues it will weaken the program and eventually lead to its failure.

Possible Solutions for Weaknesses: Faculty hired through University initiatives in support of materials related research could have a portion of their FTE clearly assigned to support the MS&E program. This could take the form of a teaching assignment in the MS&E core or service related to administration of the MS&E program. The reassignment of faculty FTE could be extended to all MS&E affiliated faculty, but especially to those recent materials focused hires (since 2010.)

RESOURCES

Strengths: Unique research strengths in the National High Magnetic Field Lab, High Performance Materials Institute, and the Applied Superconductivity Center; excellent laboratory facilities; good access to labs by students; first-year fellowships for research rotations

Weaknesses: There is no direct source of financial support; administrative support is low if program growth is desired

The MS&E program enjoys good support from university level instructional and research facilities and technologies. Of particular note are the world-class laboratories in the National High Magnetic Field Lab, HPMI, and ASC. All of these facilities provide great visibility to FSU and are attractive to both potential students and faculty members. Several MS&E students related that they chose to come to FSU primarily because of the presence of these lab facilities and their associated faculty.

Students are pleased with the level of IT support that they have in their offices and labs. All MS&E students have access to personal desk and office space, usually in shared rooms near their research laboratories, throughout their degree work. They are also enthusiastic about the

level of technician support for critical research infrastructure and equipment. Students also described a strong culture of shared access to research equipment and a positive collaborative experience in research, both key attributes of a successful interdisciplinary program.

Students were asked specific questions about access to library resources needed for classes and research. The response was very positive with everyone reporting that they had access to all the journal literature they needed, and that the library spaces were great for studying and meeting in small study groups.

Because the MS&E program does not have an academic departmental home, there are no direct sources of funding for the program through normal University routes; there are no faculty FTE assigned to MS&E, there are no student credit hours produced by courses taught by MS&E (other than research and thesis credits), there are no graduate teaching assistantships assigned to MS&E. The financial support for operating the program derives from 6 graduate fellowships/year for the first year research rotation (provided through the Graduate Dean), and the part-time support for the Director and Graduate Coordinator. With no other sources of revenue, the program is completely dependent on supportive agreements with individual administrators. This is not unusual for interdisciplinary programs, but does leave the program vulnerable to changes in University personnel to a greater extent than would be normal for a departmental degree program.

The current administrative resources include a part-time Director (2 weeks/year) and a part-time Graduate Coordinator (0.5 time.) Because the size of the program is small, this level of administrative support is probably about right. However, it will not be adequate if the program grows in size and scope. This is particularly important to track now that the Director is temporarily taking on additional administrative roles in the University. Increasing the number of students admitted to MS&E should be concurrent with an increase in administrative support.

One additional area that is chronically under-supported in many interdisciplinary programs is someone to keep the on-line information current and correct. Since this is often the first line of contact with potential students, as well as the first place current students look for answers to degree-related questions, it is important for the information to be constantly updated and accessible.

Possible Solutions for Weaknesses: There are no easy fixes for these weaknesses other than finding additional sources of funding for administration of the program.

OVERALL ANALYSIS

Details of the review of the program are discussed more fully in the sections above. A summary of the major strengths and weaknesses is shown in the table below.

PROGRAM STRENGTHS	PROGRAM WEAKNESSES
Curriculum	
Well designed, flexible	Core content not under program control
First-year rotation is excellent	
Students	
High quality admissions	Minimal support for teaching asst.
Good community among students	
Faculty	
High quality affiliated faculty	No faculty FTE dedicated to MS&E
Focused hiring in materials areas	
Resources	
High quality, high visibility labs (NHMFL, HPMI, ASC)	No direct financial support from University
Strong culture of shared equipment and lab resources	Growth limited by lack of administrative support

The overall analysis of the program is that Materials Science and Engineering is an active, successful graduate program with high quality faculty and students. It is highly productive in materials research and has provided significant visibility to Florida State University nationally and internationally. Unique laboratory facilities and aggressive faculty hiring have had a significant positive impact on the program. The size of the student body is small but has the opportunity for growth with additional investment from the University.

The current graduate curriculum is well designed, but is pedagogically unsound because of the lack of programmatic control over the core coursework. ***This is, in my opinion, the most important weakness that must be corrected quickly.***

The core curriculum issues are, in part, entwined with the lack of faculty FTE and direct budget support. This is a common difficulty with interdisciplinary programs, but must ultimately be addressed for continued success and growth of the program. While having more financial resources will certainly help, reassignment of current departmental resources to more specifically enable affiliated faculty to support the MS&E program can solve many of the resource issues within MS&E.

ADDITIONAL EXTERNAL REVIEWER COMMENTS/OBSERVATIONS

There are three additional issues that arose in discussions with various faculty and administrators that should be mentioned.

<u>Moving the MS&E Program into a Single College:</u> One way that universities try to make an interdisciplinary program “fit” within the existing College/Departmental structure is to move the program into a single College. Mentioned as a possibility during the review was the idea

that the MS&E program be moved from the University level (under the Graduate Dean) to the College of Engineering. The majority of the active affiliated faculty have tenure homes within the College of Engineering. This can be a successful approach if it enables more direct budgetary support for the program and provides additional control over critical aspects of the program. However, it also has the significant risk of alienating those affiliated faculty and departments outside the College of Engineering. This can significantly weaken the interdisciplinary focus of the program, curriculum, and research. The current association of MS&E with the Graduate School provides a non-disciplinary administrative home and could be maintained. If movement of the program into a single College would provide a pathway for more resources and curricular control then it should be considered. The limited university resources for the program at present (first year fellowships, Director and staff positions) should follow the program to wherever it finds an administrative home. The success of most interdisciplinary programs relies on the enthusiasm of the individuals who are in the administrative line, from the active faculty and director, through the deans and University. The current Director and Deans are very strong and key supporters of the program. Changes in personnel may point to a change in administrative home in order to provide continued support for the program, but that condition is not, in my opinion, facing the MS&E program at present.

Forming a MS&E Department: Another route for fitting interdisciplinary programs into the university structure is to develop the program into a new academic department. While this has the benefit of more easily fitting into the existing university structures, it is also expensive in terms of time commitment, financial resources, infrastructure, and staffing. Given the small size of the current MS&E program at Florida State, it is unlikely that forming a new department would be a viable option. It is noteworthy that several of the member departments already offer undergraduate specializations in materials related coursework. These materials options could be the progenitor of a future undergraduate degree offered through a new MS&E department. As the program grows, consideration of forming a department should be revisited.

MS&E in Five-Ten Years: The current MS&E program may continue as it is without additional changes to administration or direct support, but it will be limited to its current small size. Florida State would miss the opportunity to grow MS&E and allow it to become even more impactful. It is worth the effort to find a workable support path for MS&E as an exemplar for other interdisciplinary programs within the university. Interdisciplinarity will become increasingly important for the universities of the future, and spending the (time and financial) resources now to find a place for interdisciplinary programs within the university structure will pay big benefits in the future.

Biographical Sketch – Jamel Ali, Ph.D.

Department of Chemical and Biomedical Engineering
FAMU-FSU College of Engineering
2525 Pottsdamer Street,
B373FTallahassee, FL32310

Telephone: (850) 410 6282
FAX: (850) 410 6150
E-mail:
jali@eng.famu.fsu.ed
u

a) Professional Preparation

Howard University	Washington, D.C.	Chemical Engineering	B.S.	2011
Howard University	Washington, D.C.	Chemical Engineering	M.S.	2013
Drexel University	Philadelphia, PA	Mechanical Engineering	Ph.D.	2016

b) Appointments

2018–present Assistant Professor, Chemical and Biomedical Engineering, Florida A&M University.
2017–2018 Chief Technology Officer, Acrogenic Technologies
2015–2016 National Defense Science and Engineering Graduate Fellow, Drexel University
2013–2014 Graduate Research Assistant, Mechanical Engineering, Drexel University
2011–2013 Graduate Research Assistant, Chemical Engineering, Howard University

c) Key Publications (5)

1. Rogowski, L. W., **Ali**, **J.**, Zhang, X., Wilking, J. N., Fu, H. C., & Kim, M. J. (2021). Symmetry Breaking Propulsion of Magnetic Microspheres in Nonlinearly Viscoelastic Fluids(Feature Article). Nature Communications, 12, 1116. doi:https://doi.org/10.1038/s41467- 021-21322-0
2. Benhal, P., Quashie, D., Jr., Cheang, U. K., & **Ali**, **J.** (2021). Propulsion Kinematics of Achiral Microswimmers in Viscous Fluids. Applied Physics Letters, 118, 204103. doi:https://doi.org/10.1063/5.0048277
3. **Ali**, **J.**, Kim, H., Cheang, U. K., & Kim, M. J. (2016). MicroPIV measurements of flows induced by rotating microparticles near a boundary. Microfluidics and Nanofluidics, 20, 131. doi:https://doi.org/10.1007/s10404-016-1794-2
4. **Ali**, **J.**, Cheang, U. K., Martindale, J. D., Jabbarzadeh, M., Fu, H. C., & Kim, M. J. (2017). Bacteria-inspired nanorobots with flagellar polymorphic transformations and bundling. Scientific Reports, 7, 14098. doi:https://doi.org/10.1038/s41598-017-14457-y
5. Tan, L., **Ali**, **J.**, Cheang, U. K., Shi, X., Kim, D., & Kim, M. J. (2019). µ-PIV Measurementsof Flows Generated by Photolithography-Fabricated Achiral Microswimmers. Micromachines, 10(12), 865. doi:https://doi.org/10.3390/mi10120865

Research Area Summary

As both a Chemical and Biomedical Engineer my research focuses on investigating and harnessing the unique physiochemical properties of stimuli-responsive nanobiomateirals for biological and environmental applications, including the development of rheologically tuned soft polymer materials, and active colloidal machines. I have a broad background in the fields of chemistry, biology, and biophysics with extensive laboratory experience in top-down and bottom-up micro and nano manufacturing and fluidics. As a HBCU faculty member, I also aim to broaden the participation of underrepresented groups and lead a diverse team that consist of undergraduate, graduate, and postdoctoral fellows. Through the unique FAMU-FSU College of Engineering partnership, and affiliation with and lab space in the National High Magnetic Field Laboratory, I have a number of ongoing collaborations spanning the physical sciences, environmental engineering, agriculture, food and nutrition sciences, robotics, and polymer engineering.

Biographical Sketch – Natalie Y. Arnett, Ph.D.

Department of Chemical and Biomedical Engineering
FAMU-FSU College of Engineering
2525 Pottsdamer Street,
Tallahassee, FL32310

Telephone: (850) 410 6294
FAX: (850) 410 6161
E-mail:
narnett@eng.famu.fsu.edu

a) Professional Preparation

Grambling State University	Grambling, LA	Chemistry	B.S.	2003
Virginia Tech	Blacksburg, VA	Macromol. Sci and Eng	Ph.D.	2013

b) Appointments

2019–present Associate Professor, Chemical and Biomedical Engineering, Florida A&M University.
2019–present Associate Professor, Chemistry, Florida A&M University.
2011–2019 Adjunct Associate Professor, Vanderbilt University
2009–2019 Chair of Life and Physical Sciences and Associate Professor, Fisk University
2004-2009 Graduate Research Assistant, Macromolecular Science and Engineering, Virginia Tech
2003–2004 Graduate Teaching Assistant, Chemistry Department, Virginia Tech

c) Key Publications (4)

1. T.N. Thompson and Natalie Arnett **"**Effect of phosphonated triazine monomer additive in disulfonated poly(arylene ether sulfone) composite membranes for proton exchange membrane fuel cells. *Polymer*, 171, 34-44 (2019)
2. Natalie Y. Arnett. PERSPECTIVES FROM THE FIELD: Building Research and Teaching Capacity of Early Career STEM Faculty at Historically Black Colleges and Universities (HBCUs), Jan 2016, (https://static1.squarespace.com/static/57b5ee7d440243ac78571d0a/t/57bb280cd2b8576c979439a1/1471883287643/QEM_PDM_Anthology_Reflections.pdf), 1-5.
3. Thompson, Tiffany N.; Ramos-Hunter, Susan; Robertson, Jasmine; Arnett, Natalie Y., "Interfacial synthesis of Bisphenol A Tetrachlorocyclotriphosphazene from Bisphenol A and Hexachlorocyclotriphosphazene." Tetrahedron Letters (2013), 54(39), 5311-5313.
4. Natalie Y. Arnett; William L. Harrison, Anand S. Badami, Abhishek Roy, Ozzie Lane, Frank Cromer, Limin Dong, and J.E. McGrath. "Hydrocarbon and partially fluorinated sulfonated copolymer blends as functional membranes for fuel cells." *J. Power Sources* 172 (2007) 20-29.

Research Area Summary

As an Associate Professor in both the Department of Chemistry at Florida A&M University (FAMU) and the Department of Chemical and Biomedical Engineering at the FAMU-FSU College of Engineering my research focuses on the development of multifunctional polymers for fuel cell, water purifications, drug delivery, and 3D printing. Considerable interest in designing new classes of polymers/composites with tailorable chemical/physical properties and enhanced performance will be evaluated. Special focus on the physical and chemical properties of poly(arylene ether)s and polyamide polymers and the contribution of the types/amounts of groups to the overall performance of the materials is being studied in my lab. Moreover, my aim is to also cultivate the next generation of underrepresented leaders and scholars by integrating research and academics, developing collaborations with internal and external departments, and providing students with interesting and relevant research opportunities.

Biographical Sketch - Tarik J. Dickens, Ph.D.

Department of Industrial and Manufacturing Engineering
FAMU-FSU College of Engineering
2525 Pottsdamer Street, B318
Tallahassee, FL32301-6604

Telephone: (850) 410 6353
FAX: (850) 410 6342
E-mail: dickens@eng.famu.fsu.edu

PROFESSIONAL PREPARATION

Institution, Location	*Major*	*Degree*	*Year*
Florida State University, Tallahassee, Florida	Industrial Engineering	B.Sc.	2005
Florida State University, Tallahassee, Florida	Industrial Engineering	M.Sc.	2007
Florida State University, Tallahassee, Florida	Industrial Engineering	Ph.D.	2013
No Post-Doctoral Experience			

APPOINTMENTS

- August 2013 – Present: *Assistant Professor, Industrial & Manufacturing Engineering, FAMU-FSU College of Engineering*
- 2009 - 2010: *Manufacturing Engineer, General Dynamics*
- 2008 - 2010: *Research Fellow Adelaide Wilson Doctoral Fellowship*
- 2005 - 2013: *Research Associate, High Performance Materials Institute*

SELECT PUBLICATIONS

1. Joshi, K., Pollard, M., Chiari, A., & Dickens, T., “Concrete-FRP Interfacial Bond Monitoring with Self-Triggering Sensors”, Journal of Intelligent Material Systems and Structures, (2018). doi.org/10.1177/1045389X18770859
2. Roy, M., Dickens, T. J., "Additive Technology of Soluble Mold Tooling for Embedded Devices in Composite Structures: A Study on Manufactured Tolerances" (2017). http://dx.doi.org/10.1016/j.addma.2017.03.012
3. Joshi, K., Mishra, S., Campbell, C., Vanli, A., and Dickens, T. “Light emitting composite beams on matrix cracking,” Journal of Composite Materials, Sage Publications, (2017). doi: 10.1177/0021998317701556
4. Frketic, J.; Dickens, T., “Automated Manufacturing and Processing of FRP Composites: An Additive Review of Contemporary and Modern Techniques for Advanced Materials Manufacturing,” Additive Manufacturing Journal. doi: 10.1016/j.addma.2017.01.003
5. K. Joshi, M. Scheiner, D. Olawale, and T. J. Dickens. 2016. Triboluminescent Sensors for Polymer-based Composites, in Triboluminescence - Theory, Synthesis, and Applications, D.O. Olawale, O.O.I. Okoli, R.S.Fontenot, W.A. Hollerman, Editors. Springer: New York, New York, United States of America.
6. M. Scheiner, T. J. Dickens, O. Okoli. “Progress towards Self-Healing Polymers for Composite Structural Applications.” Polymer. 83, 260-282, 2016.

Lewis Johnson

POSITION TITLE & INSTITUTION: Associate Provost for Student Success and Strategic Initiatives,

Florida A&M University

PROFESSIONAL PREPARATION

INSTITUTION	LOCATION	MAJOR / AREA OF STUDY	DEGREE (if applicable)	YEAR YYYY
North Carolina State University	Raleigh, NC	Physics	BS	1990
Duke University	Durham, NC	Physics	PHD	1997
Lawrence Berkeley National Laboratory	Berkeley, CA	Physics	Postdoctoral Fellow	1998 - 1999

APPOINTMENTS

2018 - present	Associate Provost for Student Success and Strategic Initiatives, Florida A&M University , Tallassee, FL
2012 - present	Professor of Physics, Florida A&M University, Tallahssee, FL
2017 - 2018	Assistant Vice President of Strategic Planning and Performance Metrics, FloridaA&M University, Tallahassee, FL
2012 - 2017	Assistant Dean, College of Science and Technology, Florida A&M University,Tallahassee, FL
2006 – 2012	Associate Professor of Physics, Florida A&M University, Tallahassee, FL
2000 – 2006	Assistant Professor of Physics, Florida A&M University, Tallahassee, FL
1998 - 1999	Staff Scientist, Center for X-Ray Optics / LBNL, Berkeley, CA

SELECTION OF PUBLICATIONS

1. Gutsev GL, Weatherford CA, Johnson LE, Jena P. Structure and properties of the aluminum borates Al(BO2)n and Al(BO2)n(-), (n = 1-4). J Comput Chem. 2012 Feb 5;33(4):416-24. PubMed PMID: 22121015.
2. Akpovo C, Ford A, Johnson L. Optimized LWIR enhancement of nanosecond and femtosecond LIBS uranium emission. Applied Physics B. 2016; 122(5):-. Available from: http://link.springer.com/10.1007/s00340-016-6427-7 DOI: 10.1007/s00340-016-6427-7
3. Akpovo C, Helms L, Profeta L, Johnson L. Multivariate determination of 10B isotopic ratio by laser-induced breakdown spectroscopy using multiple BO molecular emissions. Spectrochimica Acta Part B: Atomic Spectroscopy. 2019 December; 162:105710-. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0584854718305494 DOI: 10.1016/j.sab.2019.105710
4. Khalil A, Richardson M, Barnett C, Johnson L. Double pulse UV laser induced breakdown

spectroscopy of stainless steel. Journal of Applied Spectroscopy. 2006; 73(5):735-742. Available from: http://link.springer.com/10.1007/s10812-006-0147-4 DOI: 10.1007/s10812-006-0147-4

5. Gutsev G, Johnson L, Belay K, Weatherford C, Gutsev L, Ramachandran B. Structure and magnetic properties of Fe12X clusters. Chemical Physics. 2014 February; 430:62-68. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0301010413004643 DOI: 10.1016/j.chemphys.2013.12.014
6. Barnett C, Bell C, Vig K, Akpovo AC, Johnson L, Pillai S, Singh S. Development of a LIBS assay for the detection of Salmonella enterica serovar Typhimurium from food. Anal Bioanal Chem. 2011 Jul;400(10):3323-30. PubMed PMID: 21424774.
7. Brown S, Ford A, Akpovo C, Martinez J, Johnson L. Matrix effects in laser ablation molecular isotopic spectrometry. Spectrochimica Acta Part B: Atomic Spectroscopy. 2014 November; 101:204-212. Available from: https://linkinghub.elsevier.com/retrieve/pii/S058485471400233X DOI: 10.1016/j.sab.2014.09.003
8. Brown SR, Akpovo CA, Martinez J, Johnson L. Plasma dynamics in double-pulse LIBS on dicarboxylic acids using combined 532 nm Nd:YAG and carbon dioxide laser pulses. Appl Spectrosc. 2014;68(9):1046-59. PubMed PMID: 25226259.
9. Hacisalihoglu G, Stephens D, Johnson L, Edington M. The use of an active learning approach ina SCALE-UP learning space improves academic performance in undergraduate General Biology. PLOS ONE. 2018; 13(5):e0197916-. Available from: https://dx.plos.org/10.1371/journal.pone.0197916 DOI: 10.1371/journal.pone.0197916
10. Hacisalihoglu G, Stephens D, Stephens S, Johnson L, Edington M. Enhancing Undergraduate Student Success in STEM Fields through Growth-Mindset and Grit. Education Sciences. 2020 October 12; 10(10):279-. Available from: https://www.mdpi.com/2227-7102/10/10/279 DOI: 10.3390/educsci10100279

SYNERGISTIC ACTIVITIES

1. Have trained a total of 8 current and former African-American and Hispanic graduate students (MS/PhD Physics and or Environmental Science) and two postdocs - Ph.D. - Dr. Cleon Barnett (Ph.D. Physics 2007) (Alabama State University), Dr. Jorge Martinez (Ph.D. Physics 2013), Dr. Staci Brown (Ph.D. Physics 2015), Dr. Candace Harris (Ph.D. Physics 2018) M.S. - Mr. John Branch (M.S Environmental Science 2003), Mr. Vinay Jain (M.S Environmental Science 2007),Teresa Eaton (M.S Chemistry 2012) (Co-Advisor)
2. Developed a SCALE-UP (Active Learning) classroom and General Physics Course at FAMU. One of the first for an HBCU

Shyam Kattel, PhD
Assistant Professor
Department of Physics
Florida A&M University
Tallahassee, FL 32307
Jones Hall 209
E-mail: shyam.kattel@famu.edu
Phone: 850-599-8462

Research Interest

Computational design of materials for clean energy generation/fuel synthesis and energy storage: Electrocatalysis, Heterogeneous catalysis, Clean energy/fuel generation, Nanomaterials.
Approach: Density functional theory (DFT) electronic structure calculations; Kinetic Monte Carlo (KMC) simulations; Microkinetic modeling; Machine learning

Education and Research Trainings

Associate Research Scientist; July-Dec 2018
Columbia University, New York, NY

Research Associate; July 2014-June, 2018
Brookhaven National Laboratory (BNL), NY

Postdoctoral Research Associate; August 2012-June, 2014
University of Pittsburgh, Pittsburgh, PA

Ph. D. in Physics; 2012
New Mexico State University, Las Cruces, NM

Masters in Physics; 2005
Tribhuvan University, Kathmandu, Nepal

Bachelor Degree, Major in Physics & Chemistry; 2001
Mahendra Morang Campus, Biratnagar, Nepal

AWARDS

Dean's Award for Graduate Excellence 2012, College of Arts and Sciences, NMSU

Merit-Based Enhancement Fellowship Award 2011-2012, Graduate School, NMSU

Roberts Memorial Leadership Award 2011, Campus Activities, NMSU

Best Comprehensive Exam Award 2010, Department of Physics, NMSU

Publications

(*=corresponding author; ‡ = co-first author, google scholar citations: 4600+; h-index = 34)

1. R. Xia, D. Tian, **S. Kattel**, B. Hasa, H. Shin, X. Ma, J.G. Chen, F. Jiao, "Electrochemical reduction of acetonitrile to ethylamine", ***Nat. Commun***. 12, 1-8.
2. D. Ologunagba, **S. Kattel***, "Transition metal oxynitride catalysts for electrochemical reduction of nitrogen to ammonia", ***Mater. Adv***., 2021, 2, 1263-1270.

3. J.H. Lee, **S. Kattel***, Y. Wang, B.M. Tackett, Z. Xie, S. Hwang, S.R. Denny, W. Xu, J. G. Chen, "Prussian blue analogues as platform materials for understanding and developing oxygen evolution reaction electrocatalysts", ***J. Catal.*** 2021, 393, 390-398.
4. Q. Chang, J. Kim, J. H. Lee, **S. Kattel***, J. G. Chen, S. Choi, Z. Chen, "Boosting Activity and Selectivity of CO_2 Electroreduction by Pre-Hydridizing Pd Nanocubes", ***Small*****,** 2021, 16, 2005305.
5. Z. Xie, D. Tian, M. Xie, S.Z. Yang, Y. Xu, N. Rui, J.H. Lee, S.D. Senanayake, K. Li, H. Wang, **S. Kattel***, J.G. Chen "Interfacial Active Sites for CO_2 Assisted Selective Cleavage of C–C/C–H Bonds in Ethane", ***Chem***, 2020, 6, 2703-2716.
6. Z. Xie, Y. Xu, M. Xie, X. Chen, J.H. Lee, E. Stavitski, **S. Kattel***, J.G. Chen "Reactions of CO_2 and ethane enable CO bond insertion for production of C_3 oxygenates", ***Nat. Commun***. 2020, 11, 1-8
7. D. Ologunagba, **S. Kattel*** "Machine Learning Prediction of Surface Segregation Energies on Low Index Bimetallic Surfaces", ***Energies***, 2020, 13, 2182.
8. Q. He, J.H. Lee, D. Liu, Y. Liu, Z. Lin, Z. Xie, S. Hwang, S. **Kattel,*** L. Song,* and J.G. Chen "Accelerating CO_2 Electroreduction to CO Over Pd Single-Atom Catalyst", ***Adv. Funct. Mater***. 2020, 2000407.
9. B.B. Dangi, **S. Kattel,*** "Growth of carbonaceous material on silicon surface: Case study of 1,3-butadiene molecule", ***Chem. Phys. Lett***. 2020, 745, 137248.
10. Q. He, D. Liu, J. H. Lee, Y. Liu, Z. Xie, S. Hwang**, S. Kattel,*** L. Song,* and J. G. Chen, "Electrochemical Conversion of CO_2 to Syngas with Controllable CO/H_2 Ratios over Co and Ni Single-Atom Catalysts", ***Angew. Chem. Int. Ed.*** 2020, 59, 3033 –3037.
11. E. Gomez, B. Yan, **S. Kattel**, and J. G. Chen, " Carbon Dioxide Reduction in Tandem with Light Alkane Dehydrogenation" ***Nat. Rev. Chem***., 2019, *3*, 638–649.
12. J. H Lee, **S**. **Kattel‡**, Z. Jiang, Z. Xie, S. Yao, B. M. Tackett, W. Xu, N. S. Marinkovic, and J. G. Chen, "Tuning the Activity and Selectivity of Electroreduction of CO_2 to Synthesis Gas using Bimetallic Catalysts" ***Nat. Commun***, 2019, 10, 3724.
13. Q. Chang, **S. Kattel**, X. Li, Z. Liang, B. Tackett, S. Denny, P. Zhang, D. Su, J. G Chen, Z. Chen, "Enhancing CC Bond Scission for Efficient Ethanol Oxidation using PtIr Nanocube Electrocatalysts", ***ACS Catal.*** 2019, 9, 7618−7625.
14. X. Yang, **S. Kattel‡**, J. Nash, X. Chang, J. H. Lee, Y. Yan, J. G. Chen, B. Xu, "Quantification of Active Sites and Elucidation of Reaction Mechanism of Electrochemical Nitrogen Reduction Reaction on Vanadium Nitride", ***Angew. Chem. Int. Ed.*** 2019, 131, 13906–13910.
15. W. W. Luc, B. H. Ko, **S. Kattel**, S. Li, D. Su, J. G. Chen, F Jiao, "SO_2-induced Selectivity Change in CO_2 Electroreduction" ***J. Am. Chem. Soc.*** 2019, 141, 9902-9909.
16. B. Yan, B. Zhao, **S. Kattel**, Q. Wu, S. Yao, D. Su, J. G. Chen, "Tuning CO_2 hydrogenation selectivity via metal-oxide interfacial sites", ***J. Catal.*** 2019, 374, 60-71.

Before joining Florida A & M University

17. J. Wang, **S. Kattel**,‡ C.J. Hawxhurst, J.H. Lee, B.M. Tackett, K. Chang, N. Rui, C. J. Liu, J. G. Chen "Enhancing Activity and Reducing Cost for Electrochemical Reduction of CO_2 by Supporting Palladium on Metal Carbides", ***Angew. Chem. Int. Ed.*** 2019, 58, 6271-6275
18. Y. Wang, **S. Kattel**,‡ W. Gao, K. Li, P. Liu, J. G. Chen, H. Wang, "Exploring the ternary interactions in Cu–ZnO–ZrO_2 catalysts for efficient CO_2 hydrogenation to methanol", ***Nat. Commun.*** 2019, 10, 1166.
19. W. Zhu, **S. Kattel**,‡ F Jiao, J. G. Chen, "Shape-Controlled CO_2 Electrochemical Reduction on Nanosized Pd Hydride Cubes and Octahedra", ***Adv. Energy Mater***. 2019, 9, 1802840.
20. X. Yang, J. Nash, J. Anibal, M. Dunwell, **S. Kattel**, E. Stavitski, K. Attenkofer, J. G. Chen, Y. Yan, and B. Xu, "Mechanistic Insights into Electrochemical Nitrogen Reduction Reaction on Vanadium Nitride Nanoparticles", ***J. Am. Chem. Soc.*** 2018, 140,13387-13391 .
21. J. H. Lee, **S. Kattel**,‡ Z. Xie, B. M. Tackett, J. Wang, C. J. Liu, and J. G. Chen, "Understanding the Role of Functional Groups in Polymeric Binder for Electrochemical Carbon Dioxide Reduction on Gold Nanoparticles", ***Adv. Funct. Mater.*** 2018, 1804762.
22. K. A. Kuttiyiel, **S. Kattel**, S. Cheng, J. H. Lee, L. Wu, Y. Zhu, G. G. Park, P. Liu, K. Sasaki, J. G. Chen, and R. R. Adzic, "Au-Doped Stable L10 Structured Platinum Cobalt Ordered Intermetallic Nanoparticle Catalysts for Enhanced Electrocatalysis", ***ACS Appl. Energy Mater.*** 2018, 1, 3771−3777.
23. B. Yan, S. Yao, **S. Kattel**, Q. Wu, Z. Xie, E. Gomez, P. Liu, D. Su, and J. G. Chen, "Active sites for tandem reactions of CO_2 reduction and ethane dehydrogenation", ***Proc. Natl. Acad. Sci.*** 2018, 115, 8278-8283.
24. **S. Kattel**, J. G. Chen and P. Liu, "Mechanistic study of dry reforming of ethane by CO_2 on a bimetallic PtNi (111) model surface", ***Catal. Sci. & Technol***. 2018, 8, 3748–3758 (Back cover).
25. J. Wang, S. **Kattel**, Z. Wang, J. G Chen and C.J. Liu, "L-Phenylalanine Templated Platinum Catalyst with Enhanced Performance for Oxygen Reduction Reaction", ***ACS Appl. Mater. & Interfaces***, 2018, 10, 21321−21327.
26. Z. Xie, B. Yan, **S. Kattel**, J. H. Lee, S. Yao, Q. Wu, N. Rui, E. Gomez, Z. Liu, W. Xu, L. Zhang, and J. G. Chen, "Dry reforming of methane over CeO_2-supported Pt-Co catalysts with enhanced activity", ***Appl. Catal. B: Environ.*** 2018, 236, 280–293.
27. R. C. E. Hamlyn, M. Mahapatra, D. C. Grinter, F. Xu, S. Luo, R. M. Palomino, **S. Kattel**, I. Waluyo, P. Liu, D. J. Stacchiola, S. D. Senanayake and J. A. Rodriguez, "Imaging the ordering of a weakly adsorbed two-dimensional condensate: ambient-pressure microscopy and spectroscopy of CO_2 molecules on rutile TiO_2(110)", ***Phys. Chem. Chem. Phys.*** 2018, 20, 13122-13126.

28. E. Gomez, **S. Kattel**, B. Yan, S. Yao, P. Liu, and J. G. Chen, "Combining CO_2 reduction with propane oxidative dehydrogenation over bimetallic catalysts", ***Nat. Commun***, 2018, 9, 1398. (Highlighted in BNL: ChemistryViews, Phy.org)
29. L. Wang, S. Zhu, N. Marinkovic, **S. Kattel**, M. Shao, B. Yang, and J. G. Chen, "Insight into the synergistic effect between nickel and tungsten carbide for catalyzing urea electrooxidation in alkaline electrolyte", ***Appl. Catal. B: Environ.*** 2018, 232, 365–370.
30. X. Li, B. Yan, S. Yao, **S. Kattel**, J. G. Chen, and T. Wang, "Oxidative Dehydrogenation and Dry Reforming of n-Butane with CO_2 over NiFe Bimetallic Catalysts", ***Appl. Catal. B: Environ.*** 2018, 231, 213–223.
31. B. M. Tackett, W. Sheng, **S. Kattel**, S. Yao, B. Yan, K. A. Kuttiyiel, Q. Wu, and J. G. Chen, "Reducing Iridium Loading in Oxygen Evolution Reaction Electrocatalysts Using Core-Shell Particles with Nitride Cores", ***ACS Catal.*** 2018, 8, 2615-2621.
32. **S. Kattel***, P. Liu and J. G. Chen, "Tuning Selectivity of CO_2 Hydrogenation Reactions at the Metal/Oxide Interface", ***J. Am. Chem. Soc.*** 2017, 139, 9739-9754. (Highlighted in JACS spotlights)
33. **S. Kattel**, P. J. Ramírez, J. G. Chen, J. A. Rodriguez, and P. Liu, "Active Sites for CO_2 Hydrogenation to Methanol on Cu/ZnO Catalysts", ***Science*** 2017, 355, 1296-1299. (News coverage in BNL, ChemistryViews, Phy.org, Daily Mail, Chemical and Engineering News)
34. W. Sheng, **S. Kattel**, S. Yao, B. Yan, C. J. Hawxhurst, Q. Wu, and J. G. Chen, "Electrochemical Reduction of CO_2 to Synthesis Gas with Controlled CO/H_2 Ratios", ***Energy Environ. Sci***. 2017, 10, 1180-1185. (Back cover article)
35. X. Li, W. Wan, **S. Kattel**, J. G. Chen, and T. Wang, "Selective Hydrogenation of Biomass-Derived 2(5H)-Furanone over Pt-Ni and Pt-Co Bimetallic Catalysts: From Model Surfaces to Supported Catalysts", ***J. Catal.*** 2016, 344, 148-156.
36. B. Yan, X. Yang, J. Wan, M. Myint, **S. Kattel**, W. Xu, and J. G. Chen, "Dry Reforming of Ethane and Butane with CO_2 over PtNi/CeO_2 Bimetallic Catalysts", ***ACS Catal.*** 2016, 6, 7283-7292.
37. **S. Kattel**, B. Yan, Y. Yang, J. G. Chen, and P. Liu, "Optimizing Binding Energies of Key Intermediates for CO_2 Hydrogenation to Methanol over Oxide-Supported Copper", ***J. Am. Chem. Soc.*** 2016, 138, 12440-12450.
38. T. Nguyen-Phan, S. Luo, D. Vovchok, J. Llorca, S. Sallis, **S. Kattel**, W. Xu, L. F. J. Piper, D. E. Polyansky, S. D. Senanayake, D. J. Stacchiola, and J. A. Rodriguez, "Three-Dimensional Ruthenium-Doped TiO_2 Sea Urchins for Enhanced Visible-Light-Responsive H_2 Production", ***Phys. Chem. Chem. Phys.*** 2016, 18, 15972-15979.
39. **S. Kattel**, W. Yu, B. Yan, X. Yang, Y. Huang, W. Wan, P. Liu, and J. G. Chen, "CO_2 Hydrogenation over Oxide-Supported PtCo Catalysts: The Role of the Oxide Support in Determining the Product Selectivity", ***Angew. Chem. Int. Ed.*** 2016, 55, 7968-7973. (Selected as Hot Paper).

40. **S. Kattel**, B. Yan, J. G. Chen, and P. Liu, "CO_2 Hydrogenation on Pt, Pt/SiO_2 and Pt/TiO_2: Importance of Synergy between Pt and Oxide Support", ***J. Catal.*** 2016, 343, 115-126.

41. K. Liu, **S. Kattel**, V. Mao, and G. Wang, "Electrochemical and Computational Study of Oxygen Reduction Reaction on Non-Precious Transition Metal/Nitrogen Doped Carbon Nanofibers in Acid Medium", ***J. Phys. Chem. C*** 2016*,* 120, 1586-1596.

42. M. D. Porosoff, M. Myint, **S. Kattel**, Z. Xie, E. Gomez, P. Liu, and J. G. Chen, "Identifying Different Types of Catalysts for CO_2 Reduction by Ethane through Dry Reforming and Oxidative Dehydrogenation", ***Angew. Chem. Int. Ed.*** 2015, 54, 15501-15505.

43. X. Yang, **S. Kattel**, S. D. Senanayake, J. A. Boscoboinik, X. Nie, J. Graciani, J. A. Rodriguez, P. Liu, D. J. Stacchiola, and J. G Chen, "Low Pressure CO_2 Hydrogenation to Methanol over Gold Nanoparticles Activated on a CeO_x/TiO_2 Interface", ***J. Am. Chem. Soc.*** 2015, 137, 10104-10107.

44. X. Yang, **S. Kattel**, K. Xiong, K. Mudiyanselage, S. Rykov, S. D. Senanayake, J. A. Rodriguez, P. Liu, D. J. Stacchiola, and J. G. Chen, "Direct Epoxidation of Propylene over Stabilized Cu^+ Surface Sites on Titanium- Modified Cu_2O", ***Angew. Chem. Int. Ed.*** 2015, 54, 11946 -11951. (Frontispiece)

45. Y. Zhou, Q. Lu, Z. Zhuang, G. S. Hutchings, **S. Kattel**, Y. Yan, J. G. Chen, J. Q. Xiao, and F. Jiao, "Oxygen Reduction at Very Low Overpotential on Nanoporous Ag Catalysts", ***Adv. Energy Mater.*** 2015, 1500149.

46. M. D. Porosoff, **S. Kattel**, W. Li, P. Liu, and J. G. Chen, "Identifying Trends and Descriptors for Selective CO_2 Conversion to CO over Transition Metal Carbides", ***Chem. Commun.*** 2015, 51, 6988-6991.

47. W. Yuan, Y. Jiang, Y. Wang, **S. Kattel**, Z. Zhang, L.Y. Chou, C. K. Tsung, X. Wei, J. Li, X. Zhang, G. Wang, S. X. Mao, and Z. Zhang, "In Situ Observation of Facet-Dependent Oxidation of Graphene on Platinum in an Environmental TEM", ***Chem. Commun.*** 2015, 51, 350-353.

48. **S. Kattel**, and G. Wang, "Beneficial Compressive Strain for Oxygen Reduction Reaction on Pt(111) Surface", ***J. Chem. Phys.*** 2014, 141, 124713.

49. **S. Kattel**, P. Atanassov, and B. Kiefer, "A Density Functional Theory Study of Oxygen Reduction Reaction on Non-PGM Fe-N_x-C Electrocatalysts", ***Phys. Chem. Chem. Phys.*** 2014, 16, 13800-13806.

50. **S. Kattel**, P. Atanassov, and B. Kiefer, "Density functional Theory Study of the Oxygen Reduction Reaction Mechanism in a BN Co-Doped Graphene Electrocatalyst", ***J. Mater. Chem. A*** 2014, 2, 10273-10279.

51. **S. Kattel**, and G. Wang, "Reaction Pathway for Oxygen Reduction on FeN_4 Embedded Graphene", ***J. Phys. Chem. Lett.*** 2014, 5, 452-456.

52. **S. Kattel**, "Magnetic Properties of 3d Transition Metals (Sc, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, and Zn) and Nitrogen Functionalized Armchair Graphene Nanoribbon", ***RSC Adv.*** 2013, 3, 21110–21117.

53. **S. Kattel**, and G. Wang, "A Density Functional Theory Study of Oxygen Reduction Reaction on Me-N_4 (Me=Fe, Co, or Ni) Clusters between Graphitic Pores", ***J. Mater. Chem. A*** 2013, 1, 10790-10797.
54. **S. Kattel**, Z. Duan, and G. Wang, "Density Functional Theory Study of an Oxygen Reduction Reaction on a Pt_3Ti Alloy Electrocatalyst", ***J. Phys. Chem. C*** 2013, 117, 7107-7113.
55. **S. Kattel**, P. Atanassov, and B. Kiefer, "Catalytic Activity of Co-N_x/C Electrocatalysts for Oxygen Reduction Reaction: A Density Functional Theory Study", ***Phys. Chem. Chem. Phys*.** 2013, 15, 148-153.
56. **S. Kattel**, B. Kiefer, and P. Atanassov, "Density Functional Theory Study of Ni-N_x/C Electrocatalyst for Oxygen Reduction in Alkaline and Acidic Media", ***J. Phys. Chem. C*** 2012, 116, 17378-17383.
57. **S. Kattel**, P. Atanassov, and B. Kiefer, "Stability, Electronic and Magnetic Properties of In-plane Defects in Graphene: A First-Principles Study", ***J. Phys. Chem. C*** 2012, 116, 8161-8166.
58. T. S. Olson, S. Pylypenko, **S. Kattel**, P. Atanassov, and B. Kiefer, "Selectivity of Cobalt-based Non-platinum Oxygen Reduction Catalysts in the Presence of Methanol and Formic Acid", ***J. Phys. Chem. C*** 2010, 114, 15190-15195.

Selected Presentations

Invited: National Renewable Energy Laboratory (NREL), July 2019, Golden, CO

Contributed: Florida Section of ACS meeting, May 2019, Tampa, FL

Invited: ACS Spring Meeting, 2019, April, Orlando, FL

Before joining Florida A & M University

Invited: Department Seminar, August 2018, Florida A&M University, Tallahassee, FL

Invited: Department Seminar, April 2018, Department of Materials Science and Engineering, Southern University of Science and Technology, Shenzhen, China

Invited: Department Seminar, April 2018, Department of Chemical Engineering, Tsinghua University, Beijing, China

Invited: ACS Spring meeting 2018, New Orleans, LA

Invited: ACS Fall meeting 2017, Washington DC

Invited: International Conference on Catalysis and Chemical Engineering, 2017, Baltimore, MD

Invited: August 2016, NASA Ames Research Center, Mountain View, CA **(**Division Seminar)

Invited: Departmental seminar, Chemistry and Physical Sciences Department, March, 2016, Pace University, NY (Departmental Seminar)

Contributed: ACS Fall meeting, 2015, Boston, MA

Contributed: APS March Meeting, 2013, Baltimore, MD

Contributed: APS March Meeting, 2012, Boston, MA

Contributed: APS March Meeting, 2011, Dallas, TX

Contributed: 218th ECS Meeting, 2010, Las Vegas, NV

Contributed: APS March Meeting, 2010, Portland, OR

Professional Memberships

American Chemical Society

Synergistic Activities after joining Florida A & M University

Journal Reviewer: Nature Catalysis, ACS Catalysis, The Journal of Physical Chemistry C, The Journal of Physical Chemistry Letters, Energy & Environmental Science, Chemical Communications, Nanoscale, Journal of Materials Chemistry A, Physical Chemistry Chemical Physics, Applied Surface Science

Grants Reviewer: American Chemical Society Petroleum Research Fund

Session Chair/Organizer: Division of Catalysis Science and Technology, American Chemical Society National Meetings

Summer School: NSF-HBCU/MI Summer School: Computational Modeling of Disordered Materials, June 03-07, 2019, Long Beach, MS

Workshop: NSF-AAPT New Faculty Workshop, June-24-28, 2019, Baltimore, MD

Grants Awarded

1. Research Initial Award: A computational study of hydroformylation of ethylene over heterogeneous bimetallic catalysts, NSF-HBCU-UP-RIA, $298,542, 2020 Role **PI.**
2. Unraveling the Role of Catalytic Surfaces in Planetary Atmospheres, Florida Space Grant, $25,000, 2020, Role **Co-PI**.
3. Computational screening of materials for electrochemical carbon dioxide (CO_2) conversion, XSEDE, (TG-CHE200036): 12,900 Sus (12,900 × 68 = 877,200 CPU hours, duration: 05/31/2020- 6/30/202105/12/2020, Role **PI**.
4. Computational Study of Materials for Electrochemical Conversion of CO_2, National Energy Research Scientific Computing Center (NERSC) 100,000 CPU hours, duration: 01/08/2019-01/13/2020, Role **PI**.
5. Computational Study of Transition Metal Nitride based Catalysts for Hydrogen Evolution Reaction (HER) and Electrochemical Carbon Dioxide Reduction Reaction (CO_2RR), XSEDE-CHE190032: 108,800 CPU hours, duration: 05/13/2019-05/12/2020, Role **PI**.

Pending/Declined Grants Awards/Applications after joining FAMU

1. Study of Magneto-elastic Properties of Spinel Vanadates using Spectroscopic Techniques, NSF-DMR, $543,523, 2020, Role **Co-PI,** *declined.*

2. Center of Chemical Innovation Phase I: NSF Center for the Catalytic Conversion of Natural Gas Liquids (pre-proposal), NSF, 1,800,000, Role **Co-PI**, *not invited.*
3. Research Initial Award: A computational study of hydroformylation of ethylene over heterogeneous bimetallic catalysts, NSF-HBCU-UP-RIA, $298,542, 2020 Role **PI** (pending)
4. Tuning the Selectivity of Propane Oxidation to Acrylic Acid over MoVTeNbO based Mixed-Metal Oxide Catalysts: A Theoretical Study ACS-PRF, $110,000, 2020, Role **PI** (*declined*)
5. Laser – matter Interactions: Quantum Coherent Control of Break-up & Molecular Dissociation, DoD, 2019, $660,000, Role **Co-PI** (*declined*)

FAMU Students Mentored

1) Damilola Ologunagba (Ph. D. candidate, Physics: Fall 2019 - present)
2) Dorian Moore (MS Physics: Fall, 2020 - present)
3) Michael Lynn (undergraduate, Physics: Fall, 2020 - present)
4) Fayerachel Peterson (undergraduate, Chemistry: Fall 2020 - present)
5) Liana Vigoa (undergraduate, Physics: summer + Fall, 2019)
6) Elijah Athouris (undergraduate, applied physics: summer, 2019)

Biographical Sketch – Subramanian Ramakrishnan, Ph.D.

Department of Chemical and Biomedical Engineering
FAMU-FSU College of Engineering
2525 Pottsdamer Street, A131
Tallahassee, FL32310

Telephone: (850) 410 6159
FAX: (850) 410 6150
E-mail: srama@eng.fsu.edu

a) Professional Preparation

Indian Institute of Technology	Madras, India	Chemical Engineering	B.S.	1995
University of Illinois at Urbana-Champaign	Urbana, IL	Chemical Engineering	M.S.	1998
University of Illinois at Urbana-Champaign	Urbana, IL	Chemical Engineering	Ph.D.	2001
Princeton University	Princeton, NJ	Chemical Engineering		2001-2002
University of Illinois at Urbana-Champaign	Urbana, IL	Chemical Engineering		2002-2005

b) Appointments

2018–present Professor, Chemical and Biomedical Engineering, Florida A&M University.
2011–2018 Associate Professor, Chemical and Biomedical Engineering, Florida A&M University.
2005–2011 Assistant Professor, Chemical and Biomedical Engineering, Florida A&M University.
All appointments at Department of Chemical and Biomedical Engineering, FAMU-FSU College of Engineering

c) Key Publications (5)

1. Haney, R., Tran, P., Koerner, H., Trigg, E., Dickens, T., & Ramakrishnan, S. (2020). Printability and performance of 3D conductive graphite structures. Additive Manufacturing.
2. Shan, X., Mao, P., Li, H., Geske, T., Bahadur, D., Xin, Y., Ramakrishnan, S., & Yu, Z. (2019). 3D-Printed Photoactive Semiconducting Nanowire–Polymer Composites for Light Sensors. ACS Applied Nano Materials.
3. Mondal, A., Gebeyehu, A., Mariza, M., Bahadur, D., Ramakrishnan, S., Rishi, A., & Singh, M. (2019). Characterization and Printability of Sodium Alginate-Gelatin Hydrogel for Bioprinting NSCLC co-culture. Scientific Reports (Nature), 9:19914, 1-9.
4. Bahadur, D., Zhang, Q., Dufresne, E., Grybos, P., Kmon, P., Leheny, R., Maj, P., Narayanan, S., Szczygiel, R., Swan, J., Sandy, A., & Ramakrishnan, S. (2019). Evolution of structure and dynamics of thermo-reversible nanoparticle gels—A combined XPCS and rheology study. Journal of Chemical Physics, 151, 104902(1-17).
5. Vakil, P. N., Muhammed, F., Hardy, D., Dickens, T. J., Ramakrishnan, S., & Strouse, G. F. (2018). Dielectric Properties for Nanocomposites Comparing Commercial and Synthetic Ni and Fe3O4 Loaded Polystyrene. ACS Omega, 3, 12813-12823.

Research Area Summary: Research in my group focuses on understanding the physics, chemistry and processing of complex fluids (colloids, proteins, polymers and other "soft materials") with an aim of producing useful materials for engineering applications. In the process, we will also address fundamental questions that arise in assembling them into useful structures. My current research group consists of 1 post-doctoral associate and 4 PhD students. My work has led to a **funded sabbatical (by NSF) at Harvard University** and 3 summer faculty fellowships at AFRL. I am currently the director of the NSF funded CREST Center on additive manufacturing at FAMU – the CREST center currently has 11 domestic African American Students. I was awarded a 3M Distinguished Professorhip at FAMU beginning Jan 2021.

Keerthi Senevirathne **Curriculum Vitae**

Department of Chemistry
Florida A&M University
1530, S. Martin Luther King Jr. Blvd.
Tallahassee, FL 32307
EMAIL: keerthi.senevirathne@famu.edu
TEL: 850-599-3089

1324, Conservancy Dr. East
Tallahassee, FL 32312
Senevirathne.k@gmail.com
(850)-631-6319 (mobile)
(336)-757-8417 (home)

EDUCATION

Ph. D., Inorganic Materials Chemistry August 2008
Dept. of Chemistry, Wayne State University, Detroit, MI, USA
Advisor: Prof. Stephanie L. Brock
Dissertation: Synthesis, characterization, and assembly of metal pnictide nanoparticles, and evaluation of their physicochemical (catalytic, magnetic, and semiconductor) properties

Bachelor of Science (1st Class Honors), Chemistry January 2001
University of Kelaniya, Sri Lanka

POSITIONS HELD

- Associate professor, Department of Chemistry, Florida A&M University 2019-current
  Tallahassee, FL 32307
- Assistant professor, Department of Chemistry, Florida A&M University
  Tallahassee, FL 32307 2014-2019
- Postdoctoral Research Associate, Center for Energy, Environment and Sustainability
  Wake Forest University, Winston-Salem, NC 27109. 2011- 2014
- Adjunct Instructor, Forsyth Tech Community College,
  Winston-Salem, NC 27106 2013- 2014
- Research Associate, Institute for Fuel Cell Innovation-National Research Council
  Canada Vancouver, BC, V6T 1W5, Canada 2009 - 2011
- Graduate Teaching/Research Assistant, Department of Chemistry, Wayne State University,
  Detroit, MI 48202, USA 2003 - 2008
- Graduate Teaching, Department of Chemistry, University of Iowa
  Iowa City, IA, 52242, USA 2002 - 2003
- Assistant Lecturer, Department of Chemistry University of Kelaniya, Dalugama, Kelaniya,
  Sri Lanka 2001- 2002

RESEARCH & TEACHING EXPERIENCE

Assistant professor, Florida A&M University, Tallahassee, FL 32307 2014-current

Teaching experience:

- Taught CHM 1020 (Fundamentals of Chemistry), CHM 1045 (General Chemistry 1), CHM 3610 (Intermediate Inorganic Chemistry), CHM 5610 (Advanced Inorganic Chemistry), and CHM 1045 laboratory

Research:

- Metal oxide nanofibers; synthesis, characterization, and property evaluation in light of photocatalysis
- Inorganic materials for biodiesel production
- Anisotropic metal oxide nanomaterials synthesis and characterization

Research Associate, Wake Forest University Winston-Salem, NC 27106 2011- 2014

Research Experience:

(1) Use of low temperature and sol-gel synthetic routes to prepare $Zn_xGa_{1-x}O_xN_{1-x}$, MCM/$NaTO_3$ composites, and $In_{1-x}M_xTaO_4$ (M = Ni, Cr, Tb) photocatalysts for the generation of hydrogen and oxygen through stoichiometric water splitting and pollution remediation. Modification of synthesis conditions to make different shapes including rods, ovals, and spheres. Characterization of products by X-ray powder diffraction, transmission and scanning electron microscopies, energy dispersive spectroscopy, thermal gravimetric analysis, BET surface area analysis, diffuse reflectance spectroscopy and photocatalytic testing and product evaluation by gas chromatography.

(2) Use of solid state synthesis methods to make lithium-phosphorous-oxynitride (Li_2PO_2N) as a solid electrolyte for Li^+ ion battery application. Complete characterization by wide range of physical methods including ionic conductivity.

Teaching Experience:

- Designed and taught topics on "Introduction to nanomaterials and nanomaterials synthesis as a part of the Solid State Chemistry course CHM 366 A at the Department of Chemistry, Wake Forest University
- Developed undergraduate curriculum for environmental chemistry laboratory class CHM 120
- Mentored and trained one graduate and two undergraduate students

Trey Coury - undergraduate student, Wake Forest University, worked on synthesis of high surface area doped metal oxides

Zack Hood - undergraduate student, Wake Forest University, work on solid electrolyte materials for Li-ion batteries

Shiba Adikari - graduate student, Wake Forest University, worked on synthesis and characterization of Li_2SiO_3-Li_2PO_2N solid solutions as solid electrolyte for Li-ion batteries

Adjunct Instructor, Forsyth Technical Community College, Winston Salem, NC 27106 2013-current

(1) Taught CHM 151; General Chemistry 1 in-class lecture and laboratory classes
(2) Experienced with online teaching using Blackboard learning system. Conducted online teaching of CHM 151 General Chemistry course
(3) Utilized Blackboard learning system for communication, testing, grading, and evaluating students
(4) Participated in student recruitment and registration duties

Research Associate, NRC-Institute for Fuel Cell Innovation, Vancouver, BC, V6T 1W5 Canada **2009 - 2011**

(1) Fully involved in an applied materials project focused on developing non-carbon proton exchange membrane (PEM) fuel cell catalysts in collaboration with Ballard and Automotive Fuel Cell Cooperation (located in greater Vancouver area) as industry partners.

(2) Use of electrospinning techniques to fabricate high surface area metal-doped niobium and titanium oxide nanofibers as supports for PEM fuel cells.

(3) Use of Ultrasonic Spray Pyrolysis (USP) techniques to synthesize ceramic nanospheres of metal-doped TiO_2 (Metal=Ir, Ru, In, and Nb) and metal oxide/carbon composites as PEM fuel cell supports.
(4) Evaluation of physicochemical properties including bulk electronic conductivity, thermal and chemical durability of ceramic oxide nanomaterials.

Research Assistant - Dept. of Chemistry, Wayne State University, Detroit, MI 2003 – 2008

Research Experience:
(1) Synthesized discrete nickel phosphide (Ni_2P) nanoparticles as a hydrotreating catalyst for oil upgrading by a surfactant-assisted solution phase method and evaluated ligand-exchange/ ligand removal processes. Correlated hydrodesulfurization (HDS) activity towards a model feed of thiophene with surface area, surface functionalization, and structural transformations of Ni_2P nanoparticles and aerogels.

(2) Developed a solution-phase synthesis method of discrete manganese arsenide (MnAs) nanoparticles; evaluated their magnetic properties as a function of size and phase.

(3) Demonstrated the oxidative assembly of thiolate-capped Ni_2P, InP, and MnP into highly porous nanostructures (aerogels).

Teaching Experience **(Received certificate for excellence in teaching**):
- Teaching assistant (2003-2005) – conducted general, organic, and analytical chemistry laboratory and quiz classes, proctored and graded exams.
- Used Black board online learning management system to organize content, communicate with students, and record grades.

Assistant Lecturer – University of Kelaniya, Sri Lanka **2001- 2002**

- Design & taught (1) advanced coordination chemistry (2) symmetry and group theory (3) nuclear chemistry lecture courses for Junior (third year) undergraduate students
- Prepared and conducted organic and inorganic chemistry laboratory classes
- Supervised teaching assistants, proctored, and graded exams

TECHNICAL SKILLS

- Skilled in characterization of nanoparticles, nanofibers, aerogels by XRD, TEM & SEM, EDS, TGA, FTIR, BET surface area analysis, AAS, UV-Vis, and photoluminescence spectroscopy.

- Expertise in synthesis and handling of air and moisture sensitive materials using inert atmosphere glove box and Schlenk line techniques.

- Experienced with photocatalytic gas analysis measurements using gas chromatography (GC).

- Highly experienced in fabrication of high surface area metal oxide nanofibers by electrospinning and microspheres by ultrasonic spray pyrolysis (USP) techniques.
- Expertise in electrochemical measurements (CV) and evaluation of electrochemical surface area, mass activities, and specific activities of Pt and Pt-metal alloy based electrocatalysts supported on metal oxide nanofibers and nanoparticles.

- Experienced with supercritical fluid extraction for synthesis of high surface area mesoporous aerogels of catalytic, semiconductor, and magnetic microstructures.

- Mastery in handling high temperature reducing atmosphere furnaces.

- Ability to construct and maintain ultrasonic spray pyrolysis and electrospinner set-ups.

- Experienced at writing journal papers, technical reports, and standard operating procedures (SOP).

PUBLICATIONS AND PATENTS

1. **Senevirathne, K.;** Pitigala S.; Ramaraj, S.; Lachgar, A.; Williams, R. "Solution-phase Synthesis of Zn-doped GaN Photocatalysts: Morphology, Composition, and Catalytic Activity towards Methylene Blue Degradation and 4-nitroaniline Conversion, *A. J. Nano Mater*. **2017**, 5, 43-50
2. **Senevirathne, K.;** Lachgar, A.; Williams, R. "MCM/$NaTaO_3$ composite catalysts for organic molecule conversion: A case of *p*-nitroaniline conversion" *Journal of Physics : Conference series,* **2016,** 758, 012003, 1-14

3. Li, D.; **Senevirathne, K**.; Aquilina, L.; Brock, S. "Effect of synthetic levers on nickel phosphide nanoparticle formation: Ni_5P_4 and NiP_2", submitted to Journal of Inorganic Chemistry, 2015

4. Hitihami-Mudiyanselage, A.; **Senevirathne, K**.; Brock, S. L. "Bottom-Up Assembly of Ni2P Nanoparticles into Three-Dimensional Architectures: An Alternative Mechanism for Phosphide Gelation" Chem. Mater. **2014**, 26, 6251-6256
5. Hitihami-Mudiyanselage, A.; **Senevirathne, K**.; Brock, S. L. "Assembly of Phosphide nanocrystals into Porous Networks: Formation of InP Gels and Aerogels" *ACS Nano,* **2013**, 7, 1163-1170
6. **Senevirathne, K**.; Day, C. S.; Gross, M.; Lachgar, A.; Holzwarth, N. "A new crystalline LiPON electrolyte: Synthesis, Properties, and Electronic Structure" *Solid State Ionics*, **2013**, 233, 95**-**101
7. **Senevirathne, K.;** Neburchilov, V.; Alzate, V.; Baker, R.; Neagu, R.; Zhang, J.; Campbell, S.; Ye, S. "Nb-doped TiO_2/carbon composite supports synthesized by ultrasonic spray pyrolysis for proton exchange membrane (PEM) fuel cell catalysts" *J. Power Sources*, **2012**, 220, 1-9.
8. **Senevirathne, K**.; Hui, R.; Campbell, S.; Ye, S.; Zhang, J. " Electrocatalytic activity and durability of Pt/NbO_2 and Pt/Ti_4O_7 nanofibers for PEM fuel cell oxygen reduction reaction" *Electrochimica Acta*, **2012**, 59, 538-547.
9. Neburchilov, V.; Wang, Y.; **Senevirathne, K**.; Wilkinson, D.; Zhang, J.; Hybrid catalyst supports and supported catalysts for fuel cells and metal-air batteries (**U.S Provisional patent Application # 61/601173, 2012)**.
10. Tian, P.; Zhang, Y.; **Senevirathne, K.;** Brock, S.; Dixit, A.; Lawes, A.; Billinge, S. "Diverse structural and magnetic properties of differently prepared MnAS nanoparticles" *ACS Nano*, **2011**, 5, 2970-2978.
11. Wei, H.; Cleary, Z.; Song, P.; **Senevirathne, K.;** Eilers, H. "Fluorescence lifetime modification in Eu:Lu_2O_3 nanoparticles in the presence of silver nanoparticles" *J. Alloys Comp*. **2010**, 500, 96-101.
12. **Senevirathne, K.;** Tackett, R.; Kharel, P. R.; Lawes, G.; Somaskandan, K.; Brock, S. L. "Discrete, dispersible MnAs nanocrystals from solution method: phase control on the nanoscale and magnetic consequences" *ACS Nano* **2009**, 3, 1129-1138.
13. Brock, S. L.; **Senevirathne, K.** " Recent developments in synthetic approaches to transition metal phosphide nanoparticles for magnetic and catalytic applications" *J. Solid State Chem*. **2008**, 181, 1552-1559.
14. **Senevirathne, K.;** Burns, A.; Bussell, M. E.; Brock, S. L. "Synthesis and characterization of discrete nickel phosphide (Ni_2P) nanoparticles: effect of surface ligation chemistry on catalytic hydrodesulfurization of thiophene" *Adv. Funct. Mater.* **2007,** 17, 3933-3939**.**
15. **Senevirathne, K.;** Lachgar, A.; Williams, R. "Anisotropic Metal Oxynitride Photocatalysts for Methylene Blue Degradation: Shape Dependent Catalytic Properties" *in preparation*
16. **Senevirathne, K.;** Lachgar, A.; Williams, R. "MCM/$NaTaO_3$ composite catalysts for organic molecule conversion: A case of *p*-nitroaniline conversion" *in preparation*

CONFERENCE PRESENTATIONS AND WORKSHOPS

- **Senevirathne, K**.; Lachgar, A.; Williams, R. "$NaTaO_3$/MCM-48 composite catalysts for photocatalytic organic molecule conversion" ACS South Eastern Regional Meeting 2013, Atlanta, GA

- **Senevirathne, K**.; Williams, R.; Lachgar, A "Anisotropic Metal Oxynitride Photocatalysts for Water Splitting: Shape Dependent Catalytic Properties". ACS South Eastern Regional Meeting 2012, Raleigh, NC.
- Annual Workshop on Electrochemical Measurements: Theory and Hands on Experience, 2012, Case Western Reserve University, Cleveland, OH.
- **Senevirathne, K**.; Hui, R.; Campbell, S.; Ye, S.; Guest, A.; Zhang, J. "Synthesis and Characterization of Pt/NbO_2 Nanofibers and their Electrocatalytic Activities toward the Oxygen Reduction Reaction" Hydrogen + Fuel Cells 2011: International Conference and Exhibition, 2011, Vancouver, BC, Canada.
- **Senevirathne, K**.; Burns, A.; Bussell, M. E.; Brock, S. L "Synthesis and Characterization of Dinickel Phosphide (Ni_2P): HDS Activity Evaluation of Nanoparticles and Aerogels", 233rd American Chemical Society National Meeting, 2007, Chicago, IL.
- **Senevirathne, K**.; Burns, A.; Bussell, M. E.; Brock, S. L Advanced Workshop on Recent Developments in Nanomaterials, "Synthesis, Characterization and HDS Activity of Nickel Phosphide Nanoparticles and Aerogels", The Abdus Salam International Center for Theoretical Physics (ICTP), 2007, Trieste, Italy.
- **Senevirathne, K**.; Burns, A.; Bussell, M. E.; Brock, S. L. "Synthesis and Characterization of Nickel Phosphide: Nanoparticles to Aerogels", 8th Annual Chemistry Graduate Student Research Symposium, Wayne State University, 2006, Detroit, MI.
- **Senevirathne, K**.; Brock, S. L "Synthesis and Characterization of Discrete Nanoparticles of Ni_2P", Midwest Solid State Conference (MWSSC), University of Notre Dame, 2005, South Bend, IN.

AWARDS AND FELLOWSHIPS

- Certificate of award for excellence in undergraduate teaching services, Department of Chemistry, Wayne State University, 2007
- Graduate Research Fellowship, Institute for Manufacturing Research (IMR), Wayne State University, 2006-2007
- Award for the best oral presentation, WSU Graduate Research Symposium, 2006
- Poster presentation award, WSU Graduate Research Symposium, 2005

PROFESSIONAL AFFILIATIONS

- Member of the American Chemical Society (ACS) 2006 - current
- Member of the Electrochemical Society 2009 - 2011
- Member of the Materials Research Society 2010 - current
- Member of Phi Lambda Upsilon 2005 - current

SERVICE IN THE PEER REVIEW PROCESS

- *Nano*, *International Journal of Inorganic Chemistry*, *Radiation Measurements, and Elsevier Chemical Engineering Journal*

Dr. Komalavalli Thirunavukkuarasu

Assistant Professor
Department of Physics
Florida A&M University
111 Jones Hall
Tallahassee, FL 32307
Phone: (+1) 850 599 3925 (Office)
(+1) 850 591 6446 (Mobile)
Email : komalavalli.thirunav@famu.edu
komalavalli@magnet.fsu.edu

Education and Work Experience

Jan. 2016 – current	Assistant Professor Department of Physics Florida A&M University Tallahassee, FL, USA. Affiliate appointments: Department of Chemical and Biomedical Engineering FAMU-FSU College of Engineering Tallahassee, FL, USA National High Magnetic Field Laboratory (MagLab), Tallahassee, FL, USA.
Feb. 2015 – Dec. 2015	Visiting Associate-in-Research, MagLab, Tallahassee, FL, USA.
May 2014 – Jan. 2015	Postdoctoral research associate, MagLab, Tallahassee, FL, USA.
May 2012- May 2014	Postdoctoral research associate via Feodor-Lynen fellowship MagLab, Tallahassee, FL, USA.
Aug. 2009 – Apr. 2012	Postdoctoral scientist, II. Physikalisches Institut, Universität zu Köln, Germany.
Nov. 2004 – Jul. 2009	Ph.D. in Physics, Experimentalphysik II, Universität Augsburg, Germany.
Aug. 2003 – Nov. 2004	Master's degree in Physics, Universität Stuttgart, Stuttgart, Germany. Technical assistant, 1. Physikalisches Institut, Universität Stuttgart, Germany.

Aug. 2001 – Jun. 2003	Master's degree in Physics, Indian Institute of Technology Madras, Chennai, India.
Oct. 1999 – Jul. 2001	Technical Editor, Domex Technical Information, Chennai, India. Involved in abstracting and editing technical patents.
Jun. 1999 – Sep. 1999	Marketing management Trainee, Direct Marketing MNC, Chennai, India.
Jul. 1996 – May 1999	Bachelor's degree (vocational) in Physics, University of Madras, Chennai, India.
Jun. 1982 – May 1996	Schooling via Central Board of Secondary Education, India.

Fellowships and Grants

- 2012-2014: Feodor-Lynen Fellowship from Alexander von Humboldt Foundation, Germany.
- 2016-2019: Office of Naval Research HBCU/MI program (PI, Award: $375,000).
- 2017-2019: DoD Equipment Grant for HBCU/MI program (PI, Award: $336,000).
- 2019-2020: FSU Council on Research and Creativity (CRC) (Co-PI, Award: $63,000).
- 2019-2020: DoD Equipment Grant for HBCU/MI program (Co-PI, Award: $435,000)
- 2019-2021: User Collaboration Grant Program at NHMFL (PI, Award: $218,000).
- 2021-2023: DoD Equipment Grant for HBCU/MI program (co-PI, Award: $207,323)

Technical Skills

- Fourier-transform infrared spectroscopy (also in synchrotron radiation facility)
- Raman scattering and Photoluminescence
- High frequency electron paramagnetic resonance/electron spin resonance
- Broadband cw THz spectroscopy based on photomixing of lasers
- Handling of high magnetic fields
- High-pressure techniques (DACs, cryogenic pressure medium loading, etc.)
- Low-temperature techniques (Handling cryogenic liquids, usage of Helium-flow cold finger as well as bath cryostats)
- Resonant inelastic X-ray scattering measurements (limited experience at PSI Villigen)
- SQUID magnetometry

Academic Service

Note: Only the most significant activities are listed here

- Department of Physics Assessment Coordinator Since Fall 2017
- Florida A&M University Faculty Senate (Aug. 2016-Aug. 2018)
- Florida A&M University Strategic planning subcommittee for high impact research and commercialization (2017)
- Organizer/Participant for STEM Day, Florida A&M University
- Reviewer for international scientific journals such as American Physical Society, Modern Physics Letters, Bulletin of Materials Science, Optics Letters, Inorganic Chemistry.
- Representative for MagLab at the office of postdoctoral affairs, FSU (2013-2015)
- Diversity Committee member at MagLab (2014 and 2015, 2019-Present)
- Coordinator for postdoctoral seminar series at MagLab (2013-2015)
- Organizing team of FSU postdoc symposium 2013 and 2014
- MagLab search committees for scientists and engineers.
- Panelist in STEM careers discussion at Oasis Center for Women, Tallahassee, USA, Tallahassee Science Festival (2018).
- Regular Tour Guide (both public as well as students/scientists) – More than 10 Tours in the last 5 years and Open House Day Volunteer at MagLab.
- Speaker at Maclay School Career Day, Fall 2019
- Science Fair Judge at Griffin Middle School, Fall 2019
- NSF Reviewer Panelist for GRFP 2020 applications.
- Faculty Search Committee member in College of Science and Technology (2018, 2019).
- Panel Moderator in International EWFN Summit 2019, Tallahassee, USA.
- Science day at Pineview Elementary School in December 2019.

Teaching Experience

PERIOD	COURSE	LEVEL	DESCRIPTION
Spring Semester 2021	General Physics II & College Physics II Lab	Undergraduate	Fundamental concepts in physics based on calculus as perquisite. Laboratory course on electricity, magnetism and optics for algebra-based introductory physics course.
Fall Semester 2020	College Physics II & College Physics I Lab	Undergraduate	Fundamental concepts in physics based on algebraic mathematics
Spring Semester 2020	Condensed Matter Physics & Physics Seminar II	Undergraduate	Fundamental concepts in condensed matter physics that includes crystal structure, electronic properties, band structure, magnetism and superconductivity. The seminar consists of presentations on various physics topics from students as well as researchers.
Aug. 2018-Dec. 2019	General Physics I & II	Undergraduate	Fundamental concepts in physics explained with calculus as prerequisite
Aug. 2017-Apr. 2018	Condensed Matter Physics I & II	Graduate	Fundamental concepts in condensed matter physics that includes crystal structure, electronic properties, band structure, magnetism and superconductivity
Jan. 2016-Aug. 2017	1. General Physics Laboratory 2. College Physics Laboratory 3. College Physics I & II Lecture	Undergraduate	Fundamental concepts in physics explained with and without calculus as prerequisite
2012-2015	Run lab practicals on optical spectroscopy	Undergraduate/ Graduate	Preparing class materials and conducting lab practicals for undergraduate and graduate level students
Winter Semester 2011/12	Condensed Matter Physics I	Master (Physics)	In-charge of assignments, solution and conducting tutorial classes for the lecture of PD Dr. T. Lorenz at Institute of Physics II, University of Cologne
Summer Semester 2011	"ExperimentalPhy-sik: Struktur der Materie Teil 3 - Festkörperphysik"	Physics teachers course "Studierende des Lehramts Physik"	Responsible for preparing and supervising assignments, solutions, exam problem sheets for the lecture of PD Dr. J. Hemberger at Institute of Physics II, University of Cologne
Winter Semester 2010/11	Condensed Matter Physics I	Master (Physics)	In-charge of assignments and tutorial classes for the lecture of Prof. Dr. M. Grüninger at Institute of Physics II,

			University of Cologne
Summer Semester 2010	Solid State Physics	Bachelor (Physics)	Responsible for preparing and supervising assignments, solutions, exam problem sheets for the lecture of PD Dr. J. Hemberger at Institute of Physics II, University of Cologne
Winter Semester 2009/10	Solid State Physics II	Master (Physics)	Responsible for assignments, solution and conducting tutorial classes for the lecture of Prof. Dr. M. Grüninger at Institute of Physics II, University of Cologne
Summer Semester 2009	"Material-wissenschaften II"	Bachelor (Materials Science)	Preparation of problem sheets and solutions for Materials Science II course offered by Prof. Dr. C. Kuntscher at Chair of Experimental Physics II, University of Augsburg
Oct. 2006 – Jul. 2007	Laboratory course: Infrared spectroscopy	Bachelor (Physics/ Materials Science)	Responsibility of preparing course materials, conducting the experimental course and evaluation of students; Offered in the Chair of Experimental Physics II by Prof. Dr. C. Kuntscher, University of Augsburg

Publications List

1. Applying Unconventional Spectroscopies to the Single-Molecule Magnets, Co(PPh3)2X2 (X = Cl, Br, I): Unveiling Magnetic Transitions and Spin-Phonon Coupling, A. N. Bone, C.N. Widener, D.H. Moseley, Z. Liu, Z. Lu, Y. Cheng, L.L. Daemen, M. Ozerov, J. Telser, K. Thirunavukkuarasu, D. Smirnov, S.M. Greer, S. Hill, J. Krzystek, K. Holldack, A. Aliabadi, A. Schnegg, K.R. Dunbar, and Z. Xue, Chemistry - A European Journal **27**, 1 (2021).

2. The Future of the Correlated Electron Problem, A. Alexandradinata, N.P. Armitage, Andrey Baydin, Wenli Bi, Yue Cao, Hitesh J. Changlani, Eli Chertkov, Eduardo H. da Silva Neto, Luca Delacretaz, Ismail El Baggari, G.M. Ferguson, William J. Gannon, Sayed Ali Akbar Ghorashi, Berit H. Goodge, Olga Goulko, G. Grissonnanche, Alannah Hallas, Ian M. Hayes, Yu He, Edwin W. Huang, Anshul Kogar, Divine Kumah, Jong Yeon Lee, A. Legros, Fahad Mahmood, Yulia Maximenko, Nick Pellatz, Hryhoriy Polshyn, Tarapada Sarkar, Allen Scheie, Kyle L. Seyler, Zhenzhong Shi, Brian Skinner, Lucia Steinke, K. Thirunavukkuarasu, Thaís Victa Trevisan, Michael Vogl, Pavel A. Volkov, Yao Wang, Yishu Wang, Di Wei, Kaya Wei, Shuolong Yang, Xian Zhang, Ya-Hui Zhang, Liuyan Zhao, Alfred Zong, submitted to Nature Quantum Materials, arXiv:2010.00584 (2021).

3. Magneto-elastic coupling in multiferroic metal-organic framework $[(CH_3)_2NH_2]Co(HCOO)_3$, K. Thirunavukkuarasu, R, Richardson, Z. Lu, D. Smirnov, N. Huang, N. Combs, G. Pokharel, and D. Mandrus, AIP Advances **11**, 015040 (2021).

4. Magnetoelastic distortion of multiferroic BiFeO3 in the canted antiferromagnetic state, T. Rõõm, J. Viirok, L. Peedu, U. Nagel, D. G. Farkas, D. Szaller, V. Kocsis, S. Bordács, I. Kézsmárki, D. L. Kamenskyi, H. Engelkamp, M. Ozerov, D. Smirnov, J. Krzystek, K. Thirunavukkuarasu, Y. Ozaki, Y. Tomioka, T. Ito, T. Datta, and R. S. Fishman, Phys. Rev. B **102**, 214410 (2020).

5. Magnetic Properties and Electronic Structure of the S = 2 Complex $[Mn^{III}\{(OPPh_2)_2N\}_3]$ Showing Field-Induced Slow Magnetization Relaxation, Y. Sanakis, J. Krzystek, D. Maganas, A. Grigoropoulos, E. Ferentinos, M. Kostakis, V. Petroulea, M. Pissas, K. Thirunavukkuarasu, W. Wernsdorfer, F. Neese, P. Kyritsis Inorg. Chem. **59**, 13281 (2020).

6. Magnetostructural and EPR Studies of Anisotropic Vanadium trans- Dicyanide Molecules, M. Saber, K. Thirunavukkuarasu, S. Greer, S. Hill, K. Dunbar, Inorg. Chem. **59**, 13262 (2020).

7. Direct observation of magnetic transitions in a nickel (II) Complex with large anisotropy, C. Widener, A. Bone, M. Ozerov, R. Richardson, Z. Lu, K. Thirunavukkuarasu, D. Smirnov, X. Chen, Z. Xue, Chinese J. Inorg. Chem. **36**, 1149 (2020).

8. Inter-Kramers Transitions and Spin-Phonon Coupling in a Lanthanide-Based Single-Molecule Magnet, D. Moseley, S. Stavretis, C. Brown, M. Ozerov, D. Smirnov, Y. Cheng, L. Daemen, Z. Lu, R. Richardson, G. Knight, K. Thirunavukkuarasu, A. Ramirez-Cuesta, Z. Zhu, M. Guo, J. Tang, Z. Xue, Inorg. Chem. **59**, 5218 (2020).

9. Melting of charge order in the low-temperature state of an electronic ferroelectric. N. M. Hassan, K. Thirunavukkuarasu, Z. Lu, D. Smirnov, E. I. Zhilyaeva, S. Torunova, R. N. Lyubovskaya, N. Drichko, npj Quantum Mater. **5,** 15 (2020). Also, in Cond-mat arXiv:1905.12740.

10. Spectroscopic Studies of the Magnetic Excitation and Spin-Phonon Couplings in a Single-Molecule Magnet, S. Stavretis, D. Moseley, F. Fei, H. Cui, Y. Cheng, A. Podlesnyak, X. Wang, L. Daemen, C. Hoffmann, M. Ozerov, Z. Lu, K. Thirunavukkuarasu, D. Smirnov, T. Chang, Y. Chen, A. Ramirez-Cuesta, X. Chen, and Zi-Ling (Ben) Xue, Chem. Eur. J. **25**, 15846 (2019).

11. Spin–phonon couplings in transition metal complexes with slow magnetic relaxation, D. Moseley, S. Stavretis, K. Thirunavukkuarasu, M. Ozerov, Y. Cheng, L. Daemen, J. Ludwig, Z. Lu, D. Smirnov, C. Brown, A. Pandey, A. J. Ramirez-Cuesta, A. Lamb, M. Atanasov, E. Bill, F. Neese, Z. Xue, Nature Communications, **9**, 2572 (2018).

12. Direct observation of very large zero-field splitting in a tetrahedral $NiIISe_4$ co-ordination complex, S. Jiang, D. Maganas, N. Levesanos, E. Ferentinos, S. Haas, K. Thirunavukkuarasu, J. Krzystek, M. Dressel, L. Bogani, F. Neese, P. Kyritsis, J. Am. Chem. Soc., **137**, 12923 (2015).

13. High Photoresponsivity and Short Photo Response Times in Few-Layered WSe2Transistors, N. R. Pradhan, J. Ludwig, Z. Lu, D. Rhodes, M. M. Bishop, K.

Thirunavukkuarasu, S. A. McGill, D. Smirnov, and L. Balicas, ACS Applied Materials and Interfaces **7**, 12080 (2015).

14. Self-normalizing phase measurement in multimode terahertz spectroscopy based on photomixing of three lasers,
K. Thirunavukkuarasu, M. Langenbach, A. Roggenbuck, E. Vidal, H. Schmitz, J. Hemberger, and M. Grüninger,
Appl. Phys. Letters **106**, 031111 (2015), arXiv:1410.0648.

15. Pressure dependence of the exchange anisotropy in an organic ferromagnet,
K. Thirunavukkuarasu, S. M. Winter, C. C.Beedle, A. E. Kovalev, R. T. Oakley, and S. Hill, Phys. Rev. B **91**, 014412 (2015).

16. Group delay in THz spectroscopy with ultra-wideband log-spiral antennae,
M. Langenbach, A. Roggenbuck, I. Cámara Mayorga, A. Deninger,
K. Thirunavukkuarasu, J. Hemberger, and M. Grüninger,
J. Infrared Milli.THz Waves **35**, 918 (2014), (also on arXiv:1406.6589).

17. Electronic and magnetic structure of neutral radical FBBO,
S. M. Winter, A. Mailman, R.T. Oakley, K. Thirunavukkuarasu, S. Hill, D.E. Graf, S.W. Tozer, J. S. Tse, M. Mito, and H. Yamaguchi,
Phys. Rev. B. **89**, 214403 (2014).

18. Enhancing the stability of a continuous-wave terahertz system by photocurrent normalization,
A. Roggenbuck, M. Langenbach, K. Thirunavukkuarasu, H. Schmitz, A. Deninger, I. Cámara Mayorga, R. Güsten, J. Hemberger, and M. Grüninger,
J. Opt. Soc. Am. B, **30**, 1397 (2013).

19. Pressure effects on unoriented and oriented single-walled carbon nanotube films studied by infrared microscopy,
C. A. Kuntscher, A. Abouelsayed, K. Thirunavukkuarasu, F. Hennrich, and Y. Iwasa, J. Appl. Phys. **111**, 112614 (2012).

20. Using a fiber stretcher as a fast phase modulator in a continuous-wave terahertz spectrometer,
A. Roggenbuck, K. Thirunavukkuarasu, H. Schmitz, J. Marx, A. Deninger, I. Cámara Mayorga, J. Hemberger, R. Güsten, and M. Grüninger,
J. Opt. Soc. Am. B **29**, 614 (2012).

21. Rotational dynamics in C_{70}: Temperature- and pressure-dependent infrared studies,
K. Thirunavukkuarasu, V. C. Long, J. L. Musfeldt, F. Borondics, G. Klupp, K. Kamarás, and C. A. Kuntscher, J. Phys. Chem. C **115**, 3646 (2011).

22. Pressure-induced phenomena in single-walled carbon nanotubes: Structural phase transitions and the role of pressure transmitting medium,
C. A. Kuntscher, A. Abouelsayed, K. Thirunavukkuarasu, and F. Hennrich
phys. status solidi B **247**, 2789 (2010).

23. Role of the pressure transmitting medium for the pressure effects in single-walled carbon nanotubes,
A. Abouelsayed, K. Thirunavukkuarasu, F. Hennrich, and C. A. Kuntscher
J. Phys. Chem. C **114**, 4424 (2010).

24. Infrared spectroscopic studies on unoriented single-walled carbon nanotube films under hydrostatic pressure,
K. Thirunavukkuarasu, F. Hennrich, K. Kamarás, and C. A. Kuntscher
Phys. Rev. B **81**, 045424 (2010).

25. Pressure-induced phenomena in single-walled carbon nanotubes probed by infrared spectroscopy,
A. Abouelsayed, K. Thirunavukkuarasu, K.Kamarás, F. Hennrich, and
C.A. Kuntscher, High Pressure Research **29**, 559 (2009).

26. Orientational ordering and intermolecular interactions in the rotor-stator compounds $C_{60}\cdot C_8H_8$ and $C_{70}\cdot C_8H_8$ studied under pressure,
K. Thirunavukkuarasu, C. A. Kuntscher, Gy. Bényei, I. Jalsovszky, G. Klupp,
K. Kamarás, É. Kovats, and S. Pekker, J. Phys. Chem. C **112**, 17525 (2008).

27. Infrared spectroscopy on the fullerene C_{70} under pressure,
K. Thirunavukkuarasu, C.A. Kuntscher, F. Borondics, G. Klupp, and K. Kamarás,
phys. stat. sol. (b) **245**, 2006 (2008).

28. Infrared microreflectance study of magnetically-aligned single-walled carbon nanotubes under pressure,
C.A. Kuntscher, K. Thirunavukkuarasu, K. Kamarás, and F. Simon,
phys. stat. sol. (b) **245**, 2288 (2008).

29. Pressure-induced phenomena in single-walled carbon nanotubes,
C.A. Kuntscher, K. Thirunavukkuarasu, Á. Pekker, K. Kamarás, F. Hennrich, M. Kappes, and Y. Iwasa, phys. stat. sol. (b) **244**, 3982 (2007).

30. Infrared spectroscopy on the rotor-stator compounds $C_{60}\cdot C_8H_8$ and $C_{70}\cdot C_8H_8$ under pressure,
K. Thirunavukkuarasu, C.A. Kuntscher, Gy. Bényei, I. Jalsovszky, G. Klupp,
K. Kamarás, É. Kovats, and S. Pekker, phys. stat. sol. (b) **244**, 3857 (2007).

31. Metal-insulator transition in the low-dimensional organic conductor $(TMTSF)_2FSO_3$ probed by infrared microspectroscopy,
A. Pashkin, K. Thirunavukkuarasu, Y.-L. Mathis, W. Kang, and C. A. Kuntscher,
Eur. Phys. J. B **56**, 285 (2007).

32. Doping dependence of optical properties of low-dimensional perovskite-related $La_{1-y}Ca_yTiO_{3.4\pm\delta}$,
K. Thirunavukkuarasu, F. Lichtenberg, and C.A. Kuntscher,
J.Phys.:Condens.Matter **18**, 9173 (2006).

33. Far- and mid-infrared anisotropy of magnetically aligned single-wall carbon nanotubes studied with synchrotron radiation,

K. Kamarás, K. Thirunavukkuarasu, C.A. Kuntscher, M. Dressel, F. Simon,
H. Kuzmany, D.A. Walters, and D. A. Moss,
Infrared Physics & Technology **49**, 35 (2006).

Conference and Invited Talks

Note: Not all conferences that were attended are listed here

1. **Invited Talk**:
   Colloquium Spring 2021 at Department of Physics, Johns Hopkins University
   Title: ` Probing spin-phonon coupling in magnetic materials using magneto-Raman spectroscopy'
   Date: 28. April 2021
2. **Invited Talk**:
   Colloquium Spring 2021 at University of Massachusetts Lowell, USA
   Title: ` Probing functional materials under extreme conditions'
   Date: 14. April 2021
3. **Invited Talk**:
   86th Annual Meeting of Southeastern Section of American Physical Society (SESAPS), Wrightsville Beach, NC, USA
   Title: ` Low-energy Spectroscopy on Magnetic Materials'
   Date: 8. November 2019
4. **Invited Talk**:
   Department of Navy Opportunities Awareness Workshop, FAMU, Tallahassee, USA
   Title: `Probing functional materials under extreme conditions '
   Date: 22. September 2017
5. **Invited Talk**:
   Oak Ridge National Laboratory, Oak Ridge, Tennessee, USA
   Title: `Probing functional materials under extreme conditions '
   Date: 1. September 2017
6. **Invited Talk**:
   Joint Institute for Advanced Materials, University of Tennessee, Knoxville, Tennessee, USA
   Title: `Probing functional materials under extreme conditions '
   Date: 31. August 2017
7. Conference Talk:
   American Physical Society March Meeting 2017 at New Orleans, USA.
   Title: ` Experimental artifacts influencing polarization sensitive magneto-Raman spectroscopy '
   Date: 16. March 2017
8. Conference Talk:
   American Physical Society March Meeting 2016 at Baltimore, MD, USA.
   Title: `Probing spin excitations using magneto-Raman spectroscopy '
   Date: 16. March 2016
9. Conference Talk:
   American Physical Society March Meeting 2014 at Denver, CO, USA.

Title: `Pressure tuning of anisotropy barrier in Fe8 SMMs probed using high frequency EPR '
Date: 5. March 2014

10. Conference Talk:
South Eastern Magnetic Resonance Conference (SEMRC) 2013, Tallahassee, Florida, USA
Title: `Probing magnetic interactions in molecule-based materials using high-pressure electron paramagnetic resonance'
Date: 12. October 2013
11. Conference Talk:
10^{th} International Symposium on Crystalline Organic Metals Superconductors and Ferromagnets (ISCOM2013) at Montreal, Quebec, Canada.
Title: `Probing magnetic interactions in molecule-based materials using high-pressure electron paramagnetic resonance'
Date: 19. July 2013
12. Conference Talk:
American Physical Society March Meeting 2013 at Baltimore, MD, USA.
Title: `Probing magnetic interactions in molecule-based materials using high-pressure electron paramagnetic resonance'
Date: 18. March 2013
13. Conference Talk:
South Eastern Section of American Physical Society (SESAPS) Meeting 2012 at Tallahassee, FL, USA.
Title: `Low energy spectroscopy on molecular materials under high pressures'
Date: 15. November 2012
14. **Invited Talk**:
Magnetostructural Correlations Workshop 2012, National High Magnetic Field Laboratory, Tallahassee, Florida, USA.
Title: `Pressure-induced phenomena in single-walled carbon nanotubes probed by infrared spectroscopy'
Date: 23. April 2012
15. **Invited Talk**:
1. Physikalisches Institut, Universität Stuttgart, Germany.
Title: `Coherent broadband THz spectrometer using photomixers for accurate determination of complex dielectric function'
Date: 17. April 2012
16. **Invited Talk**:
1. Physikalisches Institut, Universität Stuttgart, Germany.
Title: `Coherent broadband cw-THz spectrometer and its application for spectroscopy at low temperatures and high magnetic fields'
Date: 25. January 2011
17. Conference Talk:
LEES 2010 at Les Diablerets,Switzerland.
Title: `Coherent broadband cw-THz spectrometer: A powerful tool for low-energy solid state spectroscopy'

Date: 08. July 2010

18. Conference Talk:
    German Physical Society (DPG) spring meeting 2010 Regensburg, Germany.
    Title: `Coherent broadband cw-THz spectrometer: A powerful tool for low-energy solid state spectroscopy'
    Date: 22. March 2010
19. **Invited Talk**:
    1. Physikalisches Institut, Universität Stuttgart, Germany.
    Title: `Pressure-induced phenomena in single-walled carbon nanotubes probed by infrared spectroscopy'
    Date: 17. June 2009
20. **Invited Talk**:
    Max Planck Institute for Solid State Research, Stuttgart, Germany.
    Title: 'Pressure-induced phenomena in single-walled carbon nanotubes probed by infrared spectroscopy'
    Date: 06. April 2009
21. Conference Talk:
    German Physical Society (DPG) Spring meeting 2008 Berlin, Germany.
    Title: `Infrared spectroscopy on the rotor-stator compounds $C_{60}\cdot C_8H_8$ and $C_{70}\cdot C_8H_8$ under pressure'
    Date: 06. April 2009
22. Conference Talk:
    German Physical Society (DPG) Spring meeting 2007 Regensburg, Germany.
    `Pressure-induced phenomena in single-walled carbon nanotubes'
    Date: 28. March 2007

Languages

English (excellent), Deutsch (good), Tamil (excellent), Hindi

Computer Skills

LaTex, Office, Origin, Igor, Linux, Programming in C, Labview, Matlab, Inventor

Tallahassee, 3rd September 2021

Komalavalli Thirunavukkuarasu

CHARLES A. WEATHERFORD Ph.D.
Vice President for Research,
Professor of Physics, and
Director of the Center for Plasma Science and Technology
Florida A&M University, Tallahassee, FL 32307

Telephone: (850)-412-5091
Telefax: (850)-412-5096
E-Mail: charles.weatherford@famu.edu

EDUCATION: B.S. in Physics, **1969**, Louisiana State University; Ph.D. in Physics, **1974**, Louisiana State University, major area; Atomic and Molecular Physics, minor area; Solid State Physics

AWARDS: **1999** Professional Excellence Award-Florida A&M U. (FAMU); **2000** Service Award-(FAMU); **2007** Elected Fellow of the National Society of Black Physicists; **2010** Researcher of the Year (FAMU); **2019** Fellow of the American Physical Society.

EMPLOYMENT RECORD: **1974-1977**: Postdoctoral Fellow, FAMU; **1978-Present**: Assistant-, Associate-, Full-Professor, FAMU; Chairperson of Physics: **1989-1999, 2005-October 2013**, FAMU; **2010-Present**--Director of the Center for Plasma Science and Technology, FAMU; **October 2013-Present**--Associate Vice President for Research, FAMU; **November 2014-Present**—Interim Vice President for Research, Interim Executive Director of Title III; Vice President for Research; Sabbatical Goddard Space Flight Center; **Summers at**: IBM-Almaden, NASA-Goddard, NASA-Ames, DOE Lawrence-Livermore, DOE Argonne.

PROFESSIONAL MEMBERSHIPS: American Physical Society, American Chemical Society, National Society of Black Physicists, Society of Industrial and Applied Mathematics

Ph.D.'s Directed:
Dr. Eddie Red (2005), Lawrence-Berkeley Laboratory, Morehouse College.
Dr. Daniel Gebremedhin (2013), FAMU Center for Plasma Science and Technology.
Dr. Boyan Hristov (2018), Florida State University Physics Department

Postgraduate Sponsor of:
(1) Dr. Ahmed Bouferguene, University of Ontario;
(2) Dr. Anil Kumar, J.P University, Chapra, India.;
(3) Paul Oppenheimer, Engineering Research Center-Mississippi State U.;
(4) Dr. Ravi Vadapalli, Engineering Research Center-Mississippi State U.;
(5) Dr. Fernando Sales-Mayor, Florida A&M University;
(6) Dr. Jilin Zhang, Florida A&M University;
(7) Dr. Genzo Tanaka, Florida A&M University;
(8) Dr. Gennady Gutsev, Florida A&M University;
(9) Dr. Daniel Gebremedhin, Florida A&M University.

Graduate Students Sponsored:
FAMU—M.S.: Mei Dong, Roy Tucker, Terrance Dubreus, Albert Wynn, Nantanette Craig, Jahwar Jain, Demetrius Fischer, Johnny Williamson; PhD: Eddie Red, Daniel Gebremedhin, Boyan Hristov, Jessica Tucker.
ERC-Mississippi State U.—co-PhD Director: Glenn Brook;
Florida Atlantic U.—M.S.: Daryl Davis

Charles A. Weatherford received his Ph.D. in Atomic and Molecular Physics theory (Electron-Molecule Scattering with Ronald Henry), and his minor in Solid State Physics theory (with

Joseph Callaway), from Louisiana State University in 1974. He is currently the Associate Vice President for Research, Professor of Physics, Interim Executive Director of Title III, and Director of the Center for Plasma Science and Technology at Florida A&M University. He has a patent disclosure—"Field-Assisted Muon-Catalyzed Fusion." Weatherford has been the principal investigator on grants totaling more than $22M and a co-PI on grants totaling more than $15M, several of which were in STEM education and STEM pipeline projects, typically integrating research into STEM education. His research interests include High Energy Density Science, Few-Body Systems, Multiparticle Dynamics, Correlation in Many-Body Quantum Chemistry, Laser-Matter Interactions, Field-Assisted Muon-Catalyzed Fusion, and Computational Science. He directed the doctoral work of Dr. Eddie Red (2006) and Dr. Daniel Gebremedhin (2013). He recently directed the doctoral work of Boyan Hristov, who graduated in August 2018.

PUBLICATIONS

Dissertation

1. **C.A. Weatherford**,"FrameTransformations in Electron-Molecule Scattering",1974 Dissertation, 256 pages, Louisiana State University, R.J.W. Henry, Director.
2.

Books

1. **C.A. Weatherford** and H.W. Jones, editors, Proceedings of the First International Conference on ETO Multicenter Molecular Integrals, 186 pages, D. Reidel, Holland, 1982.
2. Gennady L. Gutsev, Kalayu G. Belay, Lavrenty G. Gutsev, and **Charles A. Weatherford**, **Modification of the Magnetic Properties of Iron Clusters by Doping and Adsorption: From a Few Atoms to Nanoclusters**, Springer-Verlag 2015 (United Kingdom).
3.

Edited Journals

1. **Charles A. Weatherford** and Philip E. Hoggan, editors of a special edition of the International Journal of Quantum Chemistry in memory of Herbert W. Jones (2004).
2.

Peer-Reviewed (partial list)

1. Anil Kumar, Bidhan C. Saha, and **Charles A. Weatherford**, "Single Electron Capture Cross Sections by Alpha-Particles From the Ground State of K(4s) and Rb(5s): A Molecular State Approach," International Journal of Quantum Chemistry, S**70**, 909-917 (1998).
2. A. Bouferguene, **C.A. Weatherford**, and H.W. Jones, "Addition theorem of Slater-type orbitals: Application to H_2^+ in a strong magnetic field," Physical Review E**59**, 2412-2423 (1999).
3. G.L. Gutsev, P.B. Rozyczko, R.J. Bartlett, and **C.A. Weatherford**, "Does N_2^- Exist? A coupled-cluster study," Journal of Chemical Physics **110**, 5137-5139 (1999).
4. Ahmed Bouferguene, Ignatio Ema, and **Charles A. Weatherford**, "Nonadiabatic polarization potentials in electron- and positron-molecule scattering: Application to e^-+H_2 scattering," Physical Review A**59**, 2712-2718 (1999).
5. A. Kumar, B.C. Saha, **C.A. Weatherford**, and S.K. Verma, "A Systematic Study of Hornbeck Molnar Ionization Involving Rydberg Alkali Atoms," Theochem **487**, 1-9 (1999).
6. B. Ritchie and **C.A. Weatherford**, "Quantum Classical Correspondence in Nonrelativistic Electrodynamics," International Journal of Quantum Chemistry S**75**, 655-658 (1999).
7. B. Ritchie and **C.A. Weatherford**, "Nonperturbative Theory of Coulomb Retardation in Relativistic Quantum Mechanics," Journal of Molecular Structure (Theochem) 529, 113-122 (2000).
8. L. Mott and **C.A. Weatherford**, "Unexpected Constraint Implicit in the Time-Dependent Hartree-Fock Equations," Journal of Molecular Structure (Theochem) 529, 123-126 (2000).
9. B. Ritchie and **C.A. Weatherford**, "Numerical Solution of the Time-Dependent Schrödinger Equation for Continuum States," International Journal of Quantum Chemistry S**80**, 934-941 (2000)
10. **C.A. Weatherford**, "Computational Time-Dependent Two-Electron Theory and Long-Time Propagators," Computational Chemistry: Reviews of Current Trends V. 5, ed. Jerzy Leszczynski, World Scientific, Singapore, 105-140 (2000).

11. R. G. Brook, P.E. Oppenheimer, **C.A. Weatherford**, I. Baniscescu, and J. Zhu, "Solving the Hydrodynamic Formulation of Quantum Mechanics: A Parallel MLS Method," International Journal of Quantum Chemistry S**85**, 263-271 (2001).
12. **C.A. Weatherford**, E. Red, and A. Wynn, "Solution of the time-dependent Schroedinger equation using a basis in time," Journal of Molecular Structure (Theochem) **592**, 47-51 (2002).
13. R.G. Brook, P.E. Oppenheimer, **C.A. Weatherford**, I Banicescu, and J. Zhu, "Accuracy studies of a parallel algorithm for solving the hydrodynamic formulation of the time-dependent Schroedinger equation," Journal of Molecular Structure (Theochem) **592**, 69-77 (2002).
14. **C.A. Weatherford**, E. Red, and A. Wynn, "Designer Polynomials, Discrete Variable Representations, and the Schroedinger Equation," International Journal of Quantum Chemistry **90**, 1289-1294 (2002).
15. R.L. Carino, I. Banicescu, R.K. Vadapalli, **C.A. Weatherford**, T. Dubreus, J. Zhu, "Wavepacket Simulations Using the Quantum Trajectory Method with Loop Scheduling", 2003 High Performance Computing Symposium Advanced Simulation Technologies Conference, Society for Computer Simulation International, 93-99 (2003).
16. R.K. Vadapalli, **C.A. Weatherford**, I. Banicescu, R.L. Carino, and J. Zhu, "Transient Effect of a Free Particle Wave packet in the Hydrodynamic Formulation of the Time-Dependent Schrödinger Equation," International Journal of Quantum Chemistry, **94**, 1-6 (2003).
17. E. Red and C.A. **Weatherford**, "Derivation of a General Formula for the Shibuya-Wulfman Matrix," International Journal of Quantum Chemistry, **100** , 208-213 (2004).
18. R.L. Carino, I. Banicescu, R.K. Vadapalli, **C.A. Weatherford** and J. Zhu, "Message-Passing Parallel Adaptive Quantum Trajectory Method," in High Performance Scientific and Engineering Computing, L.T. Yang and Y. Pan, Editors, Kluwer Chap. 9, pp. 127-139, 2004.
19. J.L. Jain, H.W. Jones, **C.A. Weatherford**, and P.E. Hoggan, "Closed Formulae For (1s|1s), Slater Two-Center Integrals, using the Three Center Nuclear Attraction Integral Program in Spherical Coordinates," International Journal of Quantum Chemistry, **100**, 199-205 (2004).
20. B. Ritchie and **C.A. Weatherford**, "Time-Dependent Non-Wavepacket Theory of Electron Scattering," International Journal of Quantum Chemistry, **100**, 710-712 (2004).
21. B. Ritchie and **C.A. Weatherford**, "Relativistic Electron Theory: Is Spin a Property of the Electron in Vacuo or of the Electromagnetic Field Interaction," International Journal of Quantum Chemistry **100**, 1014-1018, 2004.
22. **Charles A. Weatherford** and Philip Hoggan, "Solution of the Poisson Equation Using Coulomb Forms," in Molecular Quantum Mechanics: The No Nonsense Path to Progress, An International Conference in Honour of Nicholas C. Handy, P1.64, July 24-29, 2004, St. John's College, Cambridge University, England.
23. Philip E. Hoggan and **C.A. Weatherford**, "In Memory of Herbert W. Jones (1927-2002)," International Journal of Quantum Chemistry **100**, 67-68 (2004).
24. **C.A. Weatherford,** E. Red, and P. Hoggan, "Solution of Poisson's Equation Using Spectral Forms," Molecular Physics **103**, 2169-2172 (2005).
25. **C.A. Weatherford,** E. Red, D. Joseph, and P. Hoggan, "Poisson's Equation Solution of Coulomb Integrals in Atoms and Molecules," Molecular Physics **104**, 1385-1389 (2006).
26. Genzo Tanaka and **C.A. Weatherford**, "Decomposition Pathways of Dintrotoluene", International Journal of Quantum Chemistry **108**, 2924-2934, 2008.
27. Y.M. Shulga, V.M. Martynenko, S.A. Baskakov, A.N. Trukhanenok, E.M. Anokhin, A.V. Maksimychev, S.S. Khasanov, K.G. Belay, **C.A. Weatherford**, G.L. Gutsev, "Synthesis and properties of C_{60} fullerite intercalated by acetylene," Chemical Physics Letters **483**, 115-119 (2009).
28. G.L. Gutsev, M.D. Mochena, B.C. Saha, **C.A. Weatherford**, and P.A. Derosa, "Structure and Properties of $(GaAs)_n$ Clusters", Journal of Computational and Theoretical Nanoscience **7**, 254-263 (2010).
29. G. L. Gutsev, K. G. Belay, **C. A. Weatherford**, V. N. Vasilets, E. M. Anokhin, A. V. Maksimychev, V. M. Martynenko, S. A. Baskakov, A. N. Trukhanenok, E. S. Leskova, Y. M. Shulga, "Dimerization of defect fullerenes and peculiarities of the orientational phase transition in oxidized C_{60} fullerite", Journal of Nanoscience and Nanotechnology **10**, 1-10 (2010).

30. G. L. Gutsev, R. H. O'Neal, Jr., K. G. Belay, **C. A. Weatherford**, "Non-quantum-confinement behavior of small $(CdS)_n$ clusters", Chemical Physics **368**, 113-120 (2010).
31. G.L. Gutsev, **C.A. Weatherford**, K. Pradhan, and P. Jena, "Structure and Spectroscopic Properties of Iron Oxides with the High Content of Oxygen: FeO_n and FeO_n^- (n=5–12)," Journal of Physical Chemistry A **114**, 9014-9021 (2010).
32. P. Karamanis, C. Pouchan, **C.A. Weatherford**, G.L. Gutsev, "Evolution of Properties in Prolate (GaAs)n Clusters", Journal of Physical Chemistry C, **115**, 97-107 (2011).
33. G. L. Gutsev, K. G. Belay, **C. A. Weatherford**, V. N. Vasilets, E. M. Anokhin, A. V. Maksimychev, O. V. Val'ba, V. M. Martynenko, S. A. Baskakov, E. S. Leskova, and Y. M. Shulga "Dimerization of Defect Fullerenes and the Orientational Phase Transition in Oxidized C_{60} Fullerite," Journal of Nanoscience and Nanotechnology **11**, 1887-1896 (2011).
34. Daniel Gebremedhin and **Charles A. Weatherford**, "Two-Range Addition Theorem for Coulomb Sturmians", Progress in Theoretical Chemistry and Physics B22, 71-81, P. E. Hoggan, E.J. Brändas, J. Maruani, P. Piecuch, and G. Delgado-Barrio, editors, Springer, Dordretch (2011).
35. K. Pradhan, G. L. Gutsev, **C. A. Weatherford**, P. Jena, "A systematic study of neutral and charged 3d-metal trioxides and tetraoxides", Journal of Chemical Physics 134, 144305-1-10 (2011).
36. K. Pradhan, G.L. Gutsev, **C.A. Weatherford**, and P. Jena, "Interactions of a Mn Atom With Halogen Atoms and Stability of Its Half-Filled 3d-Shell", Journal of Chemical Physics **134**, 234311-8 (2011).
37. G.L. Gutsev, **C.A. Weatherford**, K. Pradhan, and P. Jena, "Density Functional Study of Neutral and Anionic AlO_n and ScO_n with High Oxygen Content," Journal of Computational Chemistry **32**, 2974-2982 (2011).
38. Gennady L. Gutsev, **Charles A. Weatherford**, Lewis E. Johnson, Purusottam Jena, "Structure and Properties of the Aluminum Borates $Al(BO_2)_n$ and $Al(BO_2)_n^-$, (n=1-4)", Journal of Computational Chemistry **33**(4), 416-424 (2012).
39. Yuriy Shulga, Sergey Baskakov, Vyacheslav Muradyan, Dmitriy Voilov, Vyacheslay Smirnov, Alexander Michtchenko, José Cabañas-Moreno, Kalayu Belay, **Charles Weatherford**, and Gennady L. Gutsev, "Colorful Polymer Compositions With Dyed Graphene Oxide Nanosheets", International Scholarly Research Networks Optics **2012**, 1-5 (2012).
40. Gennady Gutsev, **Charles Weatherford**, Puru Jena, Elijah Johnson, Bala Ramachandran, "Structural Patterns in Carbon Chemisorption on an Icosahedral Iron Clusters", Journal of Physical Chemistry B, **116** 7050-7061 (2012).
41. James B. Titus, Alonzo B. Alexander, Kyron Williams, **Charles Weatherford**, and Joseph A. Johnson III, "FAMU Spheromak and the Turbulent Physics Experiment—STPX", Technology and Innovation **14**, 1-11, 2012.
42. B. Ritchie, **C. Weatherford,** "Algebra of Physical Space and the Geometric Space-Time Solution of Dirac's Equation," International Journal of Quantum Chemistry, DOI: 10.1002/qua.24156 (2012).
43. G.L. Gutsev, **C.A. Weatherford**, P. Jena, E. Johnson, and B.R. Ramachandran, "Structure and Properties of Fe, Fe^-_n, Fe^+_n Cluster, n=7-20", Journal of Physical Chemistry A **116**, 10218-10228 (2012).
44. D.H. Gebremedhin and **C.A. Weatherford**, "Canonical Two-Range Addition Theorem for Slater-Type Orbitals," International Journal of Quantum Chemistry **113,** 71-75 (2013).
45. Burke Ritchie and **Charles A. Weatherford**, "Quantum-Dynamical Theory of Electron Exchange Correlation", Advances in Physical Chemistry **2013**, 1-8, dx.doi.org/10.1155/2013/497267 (2013).
46. Gennady Gutsev, **Charles A. Weatherford**, Purusottam Jena, Elijah Johnson, Bala R Ramachandran, "Competition Between Surface Chemisorption and Cage Formation in $Fe_{12}O_{12}$ Cluster", Chemical Physics Letters **556**, 211-216 (2013).
47. G.L. Gutsev, **C.A. Weatherford**, K.G. Belay, B.R. Ramachandran, and P. Jena, "All-electron density functional theory study of the structure and properties of the neutral and singly charged M_{12}, and M_{13} clusters: M=Sc-Zn", Journal of Chemical Physics **138**, 164303-1 – 13 (2013).
48. G.L. Gutsev, L.E. Johnson, K.G. Belay, **C.A. Weatherford**, L.G. Gutsev, B.R. Ramachandran, "Structure and Magnetic Properties of Fe_nGd Clusters, n=12-19", European Journal of Physics D **68**, 81-89 (2014).

49. G.L. Gutsev, L.E. Johnson, K.G. Belay, **C.A. Weatherford**, L.G. Gutsev, B.R. Ramachandran, "Structure and Magnetic Properties of $Fe_{12}X$ Clusters", Chemical Physics **430**, 62-68 (2014).
50. Burke Ritchie and **Charles A. Weatherford**, "Two-Body Dirac Theory", Physical Science International Journal **4(6)**, 797-815 (2014).
51. Daniel H. Gebremedhin and **Charles A. Weatherford**, "Calculations for the One-Dimensional Soft Coulomb Problem and the Hard Coulomb Limit", Physical Review E **89**, 053319-1-053319-6 (2014).
52. **Charles Weatherford** and Daniel Gebremedhin, "The One-Dimensional Soft-Coulomb Problem and the Hard-Coulomb Limit", Bulletin of the American Physical Society **59**, 95 (2014), 45th DAMOP, June 2-6, 2014, Madison, Wi.
53. Daniel H. Gebremedhin and **Charles A. Weatherford**, "Reply to 'Comment Paper on "Calculations for the one-dimensional soft Coulomb problem and the hard Coulomb limit" ' ", Physical Review E91, 027302-1-027302-3 (2015).
54. Daniel H. Gebremedhin and **Charles A. Weatherford**, "Application of the Space-Pseudo-Time Method to Density Functional Theory", in Philip E. Hoggan, Telhat Ozdogan, editors: **Electron Correlation in Molecules—ab initio Beyond Gaussian Quantum Chemistry**, Vol 73, AIQ, UK: Academic Press, 2016, pp. 231-247.
55. Gennady Gutsev, Kalayu Belay, **Charles Weatherford**, Bala Ramachaandran, Lavrenty Gutsev, and Puru Jena, "Structure and Properties of Polyfluoride F^-_n Clusters (n=3-29)", Journal of Physical Chemistry **119**, 6483-6492 (2015).
56. Lavrenty Gutsev, Naresh Dalal, Balu Ramachandran, and **Charles Weatherford**, "Spectral Signatures of Semiconductor Clusters: $(CdSe)_{16}$ Isomers", Chemical Physics Letters **636**, 121-128 (2015).
57. Gennady Gutsev, **Charles Weatherford**, Bala Ramachandran, Lavrenty Gutsev, Weijun Zheng, Owen Thomas, Kit Bowen, "Photoelectron Spectra and Structure of the M_{nn}^- Anions (n=2-16)", Journal of Chemical Physics **143**, 044306 (2015).
58. Daniel Gebremedhin and **Charles Weatherford**, "One-Particle Effective Potential for Helium Atom", In Philip Hoggan, editor: Novel Electronic Structure Theory: General Innovations and Strongly Correlated Systems, Vol 76, AIQ, UK: Academic Press, 2018, pp. 211-222.
59. Boyan Hristov, David C. Collins, Peter Hoeflich, **Charles Weatherford** and Tiara R. Diamond, "MHD Effects ON Nuclear Burning During Deflagration OF IA SN", The Astrophysical Journal, 858:13 **(**12pp**)**, 2018 May 1.
60. Daniel Gebremedhin, **Charles Weatherford**, and Brian Wilson, "Normalizing Cluster Wavefunctions in the Interstitial Region of the Watson Sphere", In Philip Hoggan, editor: Novel Electronic Structure Theory: General Innovations and Strongly Correlated Systems, Vol 77, AIQ, UK: Academic Press, 2019.

Florida Agricultural and Mechanical University
TALLAHASSEE, FLORIDA 32307-3200
Excellence With Caring
TELEPHONE: (850) 599-3276
FAX: (850) 561-2551
OFFICE OF THE PROVOST AND
VICE PRESIDENT FOR ACADEMIC AFFAIRS

March 1, 2011

Dr. Robert Bradley
Interim Provost
Florida State University
212 Westcott
Tallahassee, FL 32306

Dear Dr. Bradley:

Thank you for sharing with me a copy of Florida State University's (FSU) proposal for a PhD in Materials Science. Former Dean Chen and Dr. Eric Hellstrom have discussed the proposal with me.

Florida A&M University (FAMU) is supportive of this proposal to establish an interdisciplinary PhD program administered by the Graduate School at FSU. The proposed degree appears to provide opportunities to students in a field that is important to the State of Florida, and to have the potential for cooperation between our two institutions that would be mutually beneficial. FAMU faculty in the joint College of Engineering may participate, as appropriate, provided that their responsibilities pertaining to FAMU are not adversely affected. We do not want the initiation of this program by FSU to preclude FAMU from initiating its own MS and PhD degree programs in Materials Science in the future in niche areas that are not duplicative of FSU's research efforts. We would appreciate FSU's expression of support of FAMU, should we seek to implement MS and PhD degrees in Materials Science in the future, and your offer to collaborate on such an endeavor, thus making efficient use of the resources at the two universities.

Sincerely,

Cynthia Hughes Harris

Cynthia Hughes Harris, PhD
Provost and Vice President for Academic Affairs

Cc Dr. John Collier, Interim Dean FAMU-FSU College of Engineering
Dr. Eric Hellstrom

FLORIDA A&M UNIVERSITY

Board of Trustees
ACTION ITEM

Academic and Student Affairs Committee
Wednesday, June 1, 2022
Agenda Item: VI

Subject: Proposed BOT Regulation 4.111 – Undergraduate Transfer Credit

Proposed Board Action: This Regulation is being proposed to provide guidance regarding undergraduate transfer credits. A summary of the regulation includes:

- A student who has attended any nationally accredited college or university and has earned 12 or more semester hours of transferable college credit since receiving a standard high school diploma or its equivalent is considered a transfer student upon admission to Florida A&M University.

The University is requesting that the Board of Trustees approve proposed Regulation 4.111 for notice and adoption in accordance with the Florida Board of Governors' Regulation Development Procedure.

Attachment: Yes

1. Regulation 4.111 – Undergraduate Transfer Credit

Florida A&M University Regulation

4.111 Undergraduate Transfer Credit.

A student who has attended any ~~regionally~~nationally accredited college or university and has earned 12 or more semester hours of transferable college credit since receiving a standard high school diploma or its equivalent is considered a transfer student upon admission to Florida A&M University (FAMU).

1. Transfer students are required to have submitted complete official academic transcripts from previous institutions that are on file in the Office of Admissions prior to evaluation.
2. Each transcript:
   a. Shall list all courses for which the student was enrolled each term, the grades for each course at the end of the term, and credits awarded;
   b. Shall contain a statement explaining the grading policy of the previous institution; and
   c. Should also specify any college credits the student earned through accelerated mechanisms.
3. Transfer students are required to be in good standing and eligible to return to the last postsecondary institution attended as a degree-seeking student and have a grade point average of at least 2.0 on a 4.0 scale on all college-level academic courses attempted.
4. To meet graduation requirements for the baccalaureate degree, a transfer student must earn at least 25 percent of the number of credit hours required to graduate in the major at FAMU.
5. Credits are transferred based on the following:
   a. The institution from which the student wishes to transfer is ~~regionally~~nationally accredited (credit can be transferred from a non-~~regionally~~nationally accredited institution that participates in the Florida Statewide Course Numbering System, per Florida Statute).
   b. The overall grade point average is at least 2.0 on a 4.0 scale on the transfer transcript.
   c. The grades of individual courses to be transferred are "C" or better, or "S" or "P."
   d. Transfer credit grades are not factored into FAMU grade point average.
6. College credits earned by high school or college students on the basis of the College Entrance Examination Board's College Level Examination Program (CLEP) subject examination, College Board Advanced Placement Program examination (AP), Advanced International Certificate of Education examination (AICE), International Baccalaureate examination (IB), and other examinations shall be accepted for transfer provided the scores attained by the student on these examinations meet the standards determined by the

Articulation Coordinating Committee (ACC) Credit-By-Exam Equivalencies as adopted by the Board of Governors (www.fldoe.org/policy/).

FAMU will award credit for specific courses for which competency has been demonstrated by successful scores on any of the examinations listed above unless the award of credit duplicates credit already awarded. Students may be exempt from courses based on the award of credit if competencies have been so demonstrated.

7. The University subscribes to the Articulation Agreement as outlined in (1007.23 F.S.). Under this agreement, graduates of Florida College System institutions who received the Associate of Arts (AA) degree shall be awarded:
   a. At least sixty (60) semester hours of academic work exclusive of occupational courses and courses not accepted in FAMU; to include Approved general education competencies and core courses credit hours in communication, humanities, mathematics, natural sciences, social sciences, and university-specified general education courses as determined in F.S. 1007.25.
8. Transfer students are required to have completed two units of one foreign language in high school or the equivalent at the postsecondary level. Transfer students not meeting this foreign language requirement upon admission must fulfill the foreign language requirement prior to completion of the baccalaureate degree (BOG Regulation 6.004).

   A student who received an Associate in Arts degree prior to September 1, 1989, or who enrolled in a program of studies leading to an Associate degree from a Florida College System institution prior to August 1, 1989, and maintains continuous enrollment shall be exempt from this admissions requirement. Any other Associate in Arts degree graduate admitted without meeting the foreign language requirement must earn 6-8 credit hours of one foreign language course prior to graduation from FAMU.

   Beginning with students initially entering a Florida College System institution or state university in 2014-2015 and thereafter, coursework for an Associate in Arts degree shall include demonstration of competency in a foreign language pursuant to F.S. 1007.262.

9. Courses within an Associate in Applied Science degree program may be accepted toward a baccalaureate degree program on an individual or block basis as authorized in inter-institutional articulation agreements with FAMU.

Any transfer student with a disability shall be eligible for reasonable substitution or modification as provided by BOG Regulation 6.018.

Specific Authority: Article IX, Section 7(c), Florida Constitution, BOG Regulation 1.001.
History: New— 12-06-21.

FLORIDA A&M UNIVERSITY

Board of Trustees
ACTION ITEM

Academic and Student Affairs Committee

Wednesday, June 1, 2022
Agenda Item: VII

Subject: BOT 2005-08 Sponsored Contracts and Grants Policy

Proposed Board Action: Approve revisions to BOT 2005-08. The policy was reviewed and amended to add definitions and enforcement.

Attachments: The amended policy is attached.

FLORIDA AGRICULTURA AND MECHANICAL UNIVERSITY
Board of Trustees Policy

Board of Trustees Policy Number: 2005-08	Date of Adoption: June 30, 2005 Date of Revision: _____ . ___, 20222~~20~~

Subject	Sponsored Contracts and Grants Policy
Authority ~~Authority~~	1004.22, F.S.; BOG Regulation 1.001, formerly found under F.S. 1001.74 Powers and duties of university BOT; FAMU Regulation 1.021 Authority of the President formerly found under F.S. 1001.75, BOT 2008-01A~~1004.22, F.S.; BOG Regulation 1.001, formerly found under F.S. 1001.74 Powers and duties~~
Applicability	All University Employees~~All regular, full-time faculty, A&P, USPS employees~~

Formatted Table

I. Policy Statement and Purpose

This document establishes authority, pursuant to Section 1004.22, F.S., the president's designee shall formally accept sponsored grants and contracts on behalf of the Board of Trustees of the Florida A & M University (Board of Trustees).

II. Definitions

President: The highest-ranking administrator at Florida A&M University (FAMU).

Signature Authority: Authority granted by the Board of Trustees given to the FAMU President to fund contracts and grants on behalf of the University.

Vice President of Research: The designated authorized official appointed by the FAMU President, to oversee all aspects of sponsored programs activities on campuses to promote sponsored projects and innovation activities.

Facilities and Administrative Costs (F&A): Costs that are incurred for common or joint objectives and, therefore, cannot be identified readily and specifically with a particular sponsored project, an instructional activity, or any other institutional activity. Also referred to as "indirect costs." This is distinguishable from the Division of Finance and Administration, which uses a similar acronym.

Principal Investigator/Program Director (PI/PD): The primary individual responsible for the preparation, conduct, and administration of a research grant, cooperative agreement, training or public service project, contract, or other sponsored project(s) in compliance with applicable laws and regulations and institutional policy governing the conduct of sponsored research. They also have the responsibility to maintain key personnel and maintain secure research data in compliance with applicable cybersecurity protocols.

Formatted: Font color: Auto

Formatted: Font color: Auto, Pattern: Clear

~~**President:** Is the highest-ranking administrator at Florida A&M University (FAMU).~~

Uniform Guidance (UG): Federal grants are maintained in compliance with the Office of Management and Budget (OMB) 2 CFR 200 Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards, commonly called Uniform Guidance. The UG is a government-wide framework for grants management and provides an authoritative set of rules and requirements for Federal awards.

Sponsored Projects and Programs: Academic or research activities supported by federal, state, or private agencies/entities. The scope of the activities is formalized by agreement.

~~**Vice President of Research:** Is the designated authorized official appointed by FAMU President, to oversee all aspects of sponsored programs activities on campuses to promote sponsored projects and innovation activities.~~

~~**Sponsored Contracts and Grants:** A sponsored project is a grant, contract or other arrangement formalizing the transfer of money or property from a sponsor to Florida A&M University with the intent to either carry out a public purpose or provide a direct benefit to the sponsor. Sponsored projects can come in various forms, including but not limited to grants, contracts and cooperative agreements.~~

III. Compliance and Responsibilities

A. Acceptance

To be accepted, grants and contracts must adhere to applicable University regulation and policy, federal and state law and regulation, Board of Governors regulation, the terms and conditions of the specific sponsored contract or grant, and internal operating procedures.

B. Reporting

The President or the President's designee shall report to the Board of Trustees annually on the status of the University's research, including sponsored contract and grant activities. Additionally, significant individual grants having a substantial impact on the academic plan or budget of the University shall be reported to the Board of Trustees on an ad hoc, but timely basis. The Vice President of Research, or designee, may establish procedures for the implementation of this section.

C. Enforcement

Contracts and grants that fail to maintain compliance with applicable policies and regulations risk termination of the grant award by the University or granting agency.

Faculty and staff members may be subject to discipline in accordance with University policies and applicable collective bargaining agreement.

The Division of Research shall establish the procedures for managing and monitoring sponsored awards. All persons granted PI/PD and Co-PI (Investigator(s)) authority must accept all of the responsibilities associated with the application for and administration of awarded sponsored projects.

~~III.~~ Sponsored projects are enforceable by law, and specified objectives are usually accomplished within a specified time frame, with payment being subject to revocation. Most sponsored projects also include facilities and administrative (F&A) costs. **Sponsored project documents that set forth terms and conditions and require signatures must be signed by all appropriate authorized signatories of the University, pursuant to applicable University policies and regulations.** ~~**Procedures, Approvals/Responsibilities**~~

Formatted: Indent: Left: 0.25"

~~**A. Procedures**~~

~~To be accepted, grants and contracts must adhere to applicable University rule and relevant federal laws and regulations and the terms and conditions of the specific sponsored grant or contract policies and internal operating memorandum procedures.~~

Formatted: Indent: Left: 0.75"

~~**B. Approvals**~~

~~The president or the president's designee shall report to the Board of Trustees annually on the status of the University's research, including sponsored grant and contract activity. Significant individual grants individual grants having a substantial impact on the academic plan or budget of the University shall be reported to the Board of Trustees on an ad hoc, but timely basis.~~

Formatted: Indent: Left: 0.75"

~~**C. Responsibilities**~~

~~Sponsored projects are enforceable by law, and specified objectives are usually accomplished within a specified time frame, with payment being subject to revocation. Most sponsored projects also include facilities and administrative (F&A) costs.~~ ~~**Sponsored project documents that set forth terms and conditions and require a signature must be signed by an authorized signatory of the University.**~~

Formatted: Indent: Left: 0.75"

Attachment(s)	N/A
Hyperlink Addresses	https://www.flbog.edu/regulations/active-regulations/ http://www.leg.state.fl.us/statutes/index.cfm?App_mode=Display_Statute&Search_String=&URL=1000-1099/1004/Sections/1004.22.html ~~https://www.flbog.edu/regulations/active-regulations/~~

	~~http://www.famu.edu/regulations/Reg%201.021-Substantial%20Reorg%208.17.17%20Final.pdf~~ ~~http://www.leg.state.fl.us/statutes/index.cfm?App_mode=Display_Statute&Search_String=&URL=1000-1099/1004/Sections/1004.22.html~~

FLORIDA A&M UNIVERSITY

Board of Trustees
ACTION ITEM

Academic and Student Affairs Committee

Wednesday, June 1, 2022
Agenda Item: VIII

Subject: BOT 2005-09 Principal Investigator Eligibility

Proposed Board Action: Approve revisions to BOT 2005-09. The policy was reviewed and amended to clarify who can be a principal investigator (PI) or related position, PI responsibilities, and compliance with University processes, state, and federal law.

Attachments: The amended policy is attached.

FLORIDA AGRICULTURAL AND MECHANICAL UNIVERSITY
Board of Trustees Policy

Board of Trustees Policy Number: 2005-09	Date of Adoption: June 30, 2005 Date of Revision: _____ . ___, 2022

Subject	Principal Investigator Policy
Authority Authority	1004.22, F.S.; BOG Regulation 1.001, ~~formerly found under F.S. 1001.74~~ Powers and duties of Uuniversity ~~BOT; FAMU~~BOT; FAMU Regulation 1.021 Authority of the President ~~formerly found under F.S. 1001.75~~; FAMU Regulations 1.019 University Code of Conduct; 4.002 College and School Governance; and 1.020 Misconduct in Research
Applicability	All employees of the University

I. Policy Statement and Purpose

This document establishes the policy on who can qualify as a Principal Investigator/Program Director (PI/PD) or Co-Principal Investigator/Co-Investigator (Co-PI/Co-I) at Florida A&M University (FAMU). When a PI/PD accepts sponsored funding, the person does so~~,~~ on behalf of FAMU Board of Trustees under the terms and conditions of the award. Thus, we as an academic community must never take our responsibility for prudent stewardship of sponsored funding for granted. The status of PI/PD is granted as a matter of privilege to University personnel, and therefore certain procedures must be ~~instituted~~ established to ensure that anyone granted such status clearly understands ~~clearly~~ the University's expectations in the fulfillment of such a role.

II. Definitions

A. **Sponsored Projects** ~~—~~ ~~are~~projects funded with grants, contracts and cooperative agreements, including but not limited to training, public service, research and cooperative projects.

B. **Principal Investigator/Program Director (PI/PD)**~~—~~ ~~is~~ the primary individual responsible for the preparation, conduct, and administration of a research grant, cooperative agreement, training or public service project, contract, or other sponsored project(s) in compliance with applicable laws and regulations and institutional policy governing the conduct of sponsored research. They also have the responsibility to maintain key personnel and maintain entry of researchers into secure enclaves.

C. **Co-Principal Investigator or Co-Investigator (Co-PI/Co-I)** –Co-PI(s)/Co-I(s) are key personnel who have responsibilities similar to that of a PI on research projects. While the PI has ultimate responsibility for the conduct of a research project, the Co-PI/Co-I is also obligated to ensure the project is

conducted in compliance with applicable laws and regulations and institutional policy governing the conduct of sponsored research.

~~C.~~D. **Key Personnel**~~ - are~~ the PI/PD(s) and other individuals who contribute to the scientific development or execution of a project in a substantive, measurable way, whether or not they receive salaries or compensation under the grant. Typically, these individuals have doctoral or other professional degrees, although individuals at the masters or baccalaureate level may be considered key personnel if their involvement meets this definition. Consultants also may be considered key personnel if they meet this definition.

~~D.~~E. **Regular Faculty**~~ -~~ includes all Assistant, Associate, and Full professors who have a full-time tenured or a tenure track appointment

~~E.~~F. **Professor Emeritus**~~ is~~ a retired professor who was granted the title as an honor. Emeriti professors may continue to work part-time following retirement and are in good standing.

~~F.~~G. **Faculty with Limited Appointments**~~ is a~~ faculty member with an appointment for a specified time, including but not limited to non-tenure appointment, adjunct, visiting, or professor emeritus.

III. Eligibility~~, Procedures, Approvals~~and ~~/~~Responsibilities

A. Who can be a PI/PD or CO-PI/CO-I?

Persons holding the following positions may be designated as PI/PD or Co-PI/Co-I in applications for sponsored funding:

1. Regular faculty and Librarians.
2. All persons holding appointments as Research Assistant Professor, Research Associate Professor and Research Professor, Extension Specialists, and Professional Professors
3. Non-tenure track faculty.
4. Faculty with Limited Appointments
5. Graduate Students or students with professional training academic appointments are eligible to serve as principal investigators on sponsored projects that the funding agency has specified as programs for which students are eligible. The student must also have a PI as Faculty Advisor/mentor.
   NOTE: In some instances, the student will be the key personnel, but a faculty member must be the PI.
6. Other Academic and Non-Academic Employees - under certain circumstances, employees holding non-academic titles may serve as principal investigators.

B. **Eligibility**[1]

[1] ~~The Division of Research shall establish a process and procedure for eligibility.~~

The Division of Research shall establish the procedure for eligibility. All persons granted PI/PD and Co-PI (Investigator(s)) authority must accept all of the responsibilities associated with the application for and administration of awarded sponsored projects. Eligibility is contingent on appropriate supervisory approval and the following understanding:

~~1. Being granted~~ PI/PD and Co-PI ~~-~~status is a privilege granted to eligible University personnel, who ~~who meet the criteria~~must confirm the following ~~identified below.~~: ~~All persons granted PI/PD and Co-PI authority must accept all of the responsibilities associated with the application for and administration of awarded sponsored projects.~~

1.
   i. ~~Each PI/PD and Co-PI certifies with every proposal submission that all information provided is true and complete and that the proposal conforms to the University policies and procedures applicable to sponsored activities. In order to be certified as a PI or Co-PI, a researcher must confirm that~~ he/she will comply with all regulatory compliance directives;
   ii. ~~that~~ all information submitted within the proposal is true, complete, and accurate to the best of his/her knowledge;
   iii. ~~that~~ any false, fictitious, or fraudulent statements or claims may subject the investigator(s) to criminal, civil, or administrative penalties; and,
   iv. ~~that~~ the investigators(s) agree to accept responsibility for the conduct of the project and to provide all required reports as applicable if a project is awarded as a result of the proposal.

C. Award Acceptance

Upon accepting the award, each PI/PD, Co-PI and, if appropriate, each key personnel, must also confirm that he/she will be responsible for:

1. ~~-~~project management of the award, ~~and agree to~~
2. carrying out the project with the highest professional standards and within the time period awarded,~~.~~
3. ~~The PI assumes responsibility to~~ reading, understanding, and complying with all of the terms and conditions contained in the award,~~.~~
4. ~~Finally, the PI must~~ confirming that he/she understands his/her responsibility to abide by University and sponsor policies, procedures and directives for the proper administration of sponsored projects,~~.~~
5. adhering to University's policies and procedures.
6. adhering to University's Intellectual Property and Conflict of Interest policies and procedures
7. complying with University processes to protect data in compliance with state and federal law, including NIST 800-171

8. Ensures that all employees working on a sponsored project also complies with University's policies and procedures.
9. Initiate disclosure process and complete Invention Disclosure Form as applicable.

~~B.~~

~~C. Who can be a PI/PD?~~

~~D. Persons holding the following positions may be designated as PI/PD or Co-PI/Co-I in applications for sponsored funding:~~

~~E. Regular faculty and Librarians.~~

~~F. All persons holding appointments as Research Assistant Professor, Research Associate Professor and Research Professor, Extension Specialists, and Professional Professors.~~

~~G. Non-tenure track faculty are eligible to act as a PI/PD or Co-PI/Co-I. A request for PI/PD or Co-PI/Co-I status shall be signed by the relevant department chair to the dean, and the Provost and Vice President for Research.~~

~~H. Faculty with Limited Appointments are eligible to serve as Co-PI on research grants and contracts and other sponsored projects upon approval by the Department Chair, Dean, Provost and Vice President for Academic Affairs and Vice President for Research.~~

~~I. Graduate Students or students with professional training academic appointments are eligible to serve as principal investigators on sponsored projects that the funding agency has specified as programs for which students are eligible. Persons in this category must receive the approval of the department head and dean of the school or college in which the school is registered, the Provost and Vice President for Academic Affairs, and the Vice President for Research. The student must also have a PI as Faculty Advisor/mentor.~~

~~*J. NOTE: In some instances, the student will be the key personnel, but a faculty member must be the PI.*~~

~~K. Other Academic and Non-Academic Employees - A & P and Other Non-Academic Employees under certain circumstances, employees holding non-academic titles may serve as principal investigators, subject to the approval of the Department Chair and Dean in which the employee is employed, the Provost and Vice President of Academic Affairs and the Vice President of Research.~~

~~L.~~

~~M. Procedures~~

~~N.~~D. Department Assurance

A request or approval should include an endorsement and an assurance that the department and college/school will assume responsibility for the conduct of grant or contract.

~~O.~~E. **Principal Investigator Training**

All PI's (existing and potential), shall attend a mandatory certification training course as a ~~criteria~~criterion for PI eligibility.

~~**PI/PD must:**~~

- ~~Adhere to University's policies and procedures.~~
- ~~Adhere to University's Intellectual Property and Conflict of Interest policies and procedures~~
- ~~Adhere to University processes to protect data in compliance with state and federal law, including NIST 800-171~~
- ~~Ensures that all employees working on a sponsored project also complies with University's policies and procedures.~~

~~P. Initiate disclosure process and complete Invention Disclosure Form as applicable.~~

~~Q.~~

~~R.~~F. **Relationships between PI/PD, University and Sponsored Projects**

Sponsored projects and their funding are awarded to the University, rather than to PIs/PDs. If a PI/PD becomes ineligible or leaves the University prior to the completion of a sponsored project, the future of that project shall be governed by the terms of the sponsored agreement, the wishes of the sponsor, the University and the PI/PD, as is appropriate in the specific circumstances.

~~S.~~G. **Relationship of PI/PD to University**

The PI's/PD's relationship to the University is governed by the University's ~~A~~appointment/employment contract document. The approval of individuals as PI/PD or Co-PIs in no way affects the rights, claims and duties of such individuals as may be specified in the University's rules and other documents governing the individual's employment. In particular, responsibilities as PI/PD or co-PI do not imply any commitment on the part of the University to any subsequent appointment beyond the term of appointment ~~than~~ in effect.

~~T.~~H. **Rescinding ~~PI~~ Investigator Status**

The University shall establish a process and procedure to rescind investigator status. An individual status as a PI/PD or Co-PI may be rescinded for just cause, but the individual may appeal the decision in accordance with applicable University policies and procedures.

~~a. Approvals/Responsibilities~~

~~Approvals and a PI's roles and responsibilities shall be further provided for in procedures as established by the Division of Research.~~

Attachment(s)	N/A
Hyperlink Addresses	Florida BOG Active Regulations Florida Statute 1004.22 Division of Sponsored Research at State Universities

FLORIDA A&M UNIVERSITY

Board of Trustees
ACTION ITEM

Academic and Student Affairs Committee

Wednesday, June 1, 2022
Agenda Item: IX

Subject: BOT 2014-01 Export Control Policy

Proposed Board Action: Approve revisions to BOT 2014-01. The policy was reviewed and amended to reflect the following:

- Additional definitions for clarity (fundamental research exemption, Technical Data/Technology expanded definition)
- Updated penalties
- Updated Authorities
- Updated links
- Updated office name

Attachments: The amended policy is attached.

Florida Agricultural & Mechanical University
Board of Trustees Policy

Board of Trustees Policy Number: 2014-01	Date of Adoption: September 11, 2014 Date of Revision: June 3, 2022

Subject	**EXPORT CONTROL POLICY**
Authority	International Traffic in Arms Regulations (ITAR) 22 CFR Parts 123 – 130; Export Administration Regulations (EAR) 15 CFR Parts 730 through 774; the Atomic Energy Act of 1954 (AEA) (Public Law 83-703); the Nuclear Regulatory Commission (NRC) 10 CFR Part 110; the Department of Energy Regulations, 10 CFR Part 810 4-209; Export Control 4 ("DEAR"), and U.S. Department of Treasury, Office of Foreign Assets Control (OFAC) sanction and embargo regulations, and other applicable federal agency export control regulations. ~~Export Administration Regulations (Department of Commerce), 15 C.F.R. Parts 730-774; **TAR.** International Traffic in Arms Regulations, 22 C.F.R. Parts 120-130; **OFAC.** U.S. Department of Treasury, Office of Foreign Assets Control Sanctions Program and Country~~
Applicability	This policy is applicable to all members of the Florida A&M University community including employees, faculty, students, researchers, contractors, and collaborators engaged in University research, education, and services.

I. Purpose and Policy Statement

A. Background and Purpose

In order to enhance U.S. national security, trade, economic competitiveness, and anti-terrorism efforts, the federal government requires individual, state and private entities that engage in international transactions to comply with U.S. export control laws and guidelines which restrict the export of certain items, commodities, and materials and requires the issuance of export licenses. U.S. export control laws govern the release of technology, technical data, software, and information to foreign nationals within or outside of U.S.; the furnishing or shipment of defense services or articles to foreign individuals in the U.S. or abroad; and the ability to export or transact with certain individuals, entities or countries.

Universities and colleges are not exempt from these laws and regulations and, as a result, federal regulations may require the University to obtain permission from the U.S. Department of State, the U.S. Department of Commerce, or the U.S. Department of Treasury, Office of Foreign Assets Control before allowing foreign nationals to participate in research involving specific technologies or before sharing research information with persons who are not citizens of the United States or permanent resident aliens (e.g. foreign national employees, professors, students, researchers, or other foreign national collaborators).

B. Policy Statement

As a public institution of higher education, Florida A&M University ("FAMU" or "University") networks, employs and collaborates with international partners on research, education and services through the establishment of international exchange programs, education of international students, attendance at conferences abroad, payments to foreign entities/individual, and the co-authorship of many international business ventures. It is the policy of FAMU that, absent extraordinary circumstance, teaching, research, and service will be accomplished openly and without prohibitions or restrictions on the publication and dissemination of the results of academic and research activities while complying with U.S. export law and regulations and pursuing applicable exemptions.

FAMU is committed to the highest level of compliance with the provisions as to export control established by the U.S. Department of Commerce through its Export Administration Regulations ("EAR"), the U.S. Department of State Controls through its International Traffic in Arms Regulations ("ITAR"), the Arms Export Control Act ("AECA"), and the Department of the Treasury Office of Foreign Assets Control ("OFAC"). The University is also dedicated to educating its employees, professors, students, researchers, contractors, and collaborators about the applicability of U.S. export control laws and

regulations in the University setting and will resolve to conduct research in harmony with U.S. export control laws and regulations.

C. Administration and Compliance Roles

FAMU's export control compliance program is administered under the authority of the Vice President for Research and such authority is delegated to the Director of the Office of Technology Transfer and Export Control within the Division of Research. ~~Export Control Compliance Office.~~ The daily management of export compliance at FAMU is carried out by an export control specialist/Director within the Division of Research. All export control license applications on behalf of FAMU are processed by and through the Office of Technology Transfer and Export Control~~Export Control Compliance Office~~.

However, it is the responsibility of University faculty, officers, staff, students, administration and collaborators to be aware of the export control requirements under the regulations and the compliance program administered by the Office of Technology Transfer and Export Control~~Export Control Compliance Office~~. For example:

- For sponsored projects, it is the responsibility of the principal investigator to ensure that the sponsored project is consistent with the export control regulations, this policy and applicable University procedures.
- If the export activity is not a sponsored project, it is the responsibility of the exporter to ensure the export is consistent with the export control regulations, this policy and applicable University procedures.

Additional University Departments/Offices may be involved in review processes and approvals, as appropriate. ~~within the University with such responsibilities include without limitation: Environmental Health and Safety, Procurement, Controllers Office, Travel Office, International Education and Development, and Human Resources.~~

II. General Information

The EAR concerns dual-use technologies, materials, items, software, and technology. The ITAR relates primarily to defense articles and services and related technical data. The OFAC regulates travel and business activities with sanctioned and embargoed countries as well as certain individuals designated on the Specially Designated Nationals (SDN) list - available at *http://www.treasury.gov/resource-center/sanctions/SDN- List/Pages/default.aspx*.

Most of the activities conducted on campus will not involve licensing requirements and will be eligible for exclusions under fundamental research exclusion, the publicly available or public domain information exclusion, or the educational exclusion. For those activities that do not fall within the exclusions, each employee is personally responsible and liable for safeguarding export-controlled data/information, i.e. controlled technology, ~~or~~ technical data, or unclassified information as required by the federal government or determination by FAMU that an export license exception or exemption is required before a foreign person or foreign national may be given access to items or technology technical information controlled by either the U.S. Department of Commerce or the U.S. Department of State. No release of classified information (i.e. confidential, secret, top ~~-~~secret) is permitted unless the receiving entity has the proper security level clearance and a documented need to know for that specific information.

For a comprehensive list of the items and activities that are designated as falling under the EAR, refer to Title 15 Part 774 of the Export Administration Regulations, accessible at *https://www.ecfr.gov/current/title-15/subtitle-B/chapter-VII/subchapter-C/part-774~~http://ecfr.gpoaccess.gov~~*. For details on how to comply with the federal regulations on export, such as the process for licensing the items, visit the U.S. Bureau of Industry and Security website at ~~http://www.bis.doc.gov/licensing/exportingbasics.htm~~.

III. Penalties

Individuals who violate U.S. export control laws and regulations are subject to civil and criminal sanctions and the University is subject to administrative sanctions, monetary fines, and loss of research funding and export privileges.

Pursuant to 22 U.S.C.S., sections 2278 through 2780, the federal government has established penalties for failure to comply with U.S. export control regulations. Such criminal and civil penalties for unlawful export and disclosure of information may include the following:

A. ITAR: Criminal penalties can reach up to $1 million per violation and ~~10~~ 20 years imprisonment for individual willful violations. Civil penalties imposed upon departments, agencies, and officials can reach up to $500,000 per violation. A university found to be in violation of ITAR regulations can be debarred from contracting with the government and could lose its export privilege.

B. EAR: Criminal violations by the University can incur penalties up to $1 million for each willful violation. For individuals, ~~these~~ criminal penalties can reach up to $1 million or 20 years imprisonment, or both, per violation. ~~Civil~~Administrative penalties for both the university and individuals can reach up to $30~~25~~0,000 per violation, or two times the value of the ~~export~~transaction, whichever is greater. Penalty maximums may be adjusted annually for inflation. These violation~~s~~ can also result in a denial of export privileges as well as other potential collateral penalties.

C. OFAC: Penalties will range depending upon the sanction regime in question. Criminal violations by the University can reach up to $1 million, and criminal penalties for individuals can reach $1 million or 20 years in prison, or both. Civil penalties can be imposed up to $250,000 per violation, or two times the transaction in question, or both.

In addition, failure to adhere to the policies and guidelines developed may be grounds for disciplinary action under applicable University regulations and collective bargaining agreements.

IV. Definitions

Additional and comprehensive definitions are found in the federal laws, regulations referenced herein.

A. **Actual Export.** Technology or information leaving the shores of the United States.

B. **Deemed Export.** An export of technology or source code (except encryption source code) is “deemed” to take place when it is released to a foreign national within the United States. This release of technology can be orally through conversation or training, or visually by reading training specifications, plans or blueprints.

C. **Dual-use item.** Items that can be used both in military and other strategic uses and in civil applications.

D. **EAR.** Export Administration Regulations (Department of Commerce), which are available at 15 C.F.R. Parts 730-774.

~~D.~~E. **ITAR.** International Traffic in Arms Regulations, available at 22 C.F.R. Parts 120-130.

~~E.~~F. **Export**. Any item that is sent from the United States to a foreign destination is an export. "Items" include commodities, software or technology, such as clothing, building materials, circuit boards, automotive parts, blue prints, design plans, retail software packages and technical information. How an item is transported outside of the United States does not matter in determining export license requirements. Regardless of the method used for the transfer, the transaction is considered an export. An item is also considered an export even if it is leaving the United States temporarily, if it is leaving the United States but is not for sale (e.g., a gift), or if it is going to a wholly-owned U.S. subsidiary in a foreign country. Even a foreign-origin item exported from the United States, transmitted or transshipped through the United States, or being returned from the United States to its foreign country of origin is considered an export. Finally, release of technology or source code subject to the EAR to a foreign national in the United States is "deemed" to be an export to the home country of the foreign national under the EAR. (See *http://www.bis.doc.gov/licensing/exportingbasics.htm)*. The official definition of export under the EAR and ITAR should be consulted when determining whether a specific act constitutes an export.

G. **Foreign National.** Any person who is not a U.S. Citizen or national; U.S. Lawful Permanent Resident; Person granted asylum; Person granted refugee status; or Temporary resident (does not include persons who hold status such as F-1, J-1, H-1, L-1 etc., or those in or outside the U.S. without status). It also means any foreign corporation, business association, partnership, trust, society or any other entity or group that is not incorporated or organized to do business in the United States, as well as international organizations, foreign governments and any agency or subdivision of foreign governments (e.g., diplomatic missions).

H. **Fundamental Research.** Basic or applied research in science and engineering performed or conducted at an accredited institution of higher learning in the United States where the resulting information is ordinarily published and share broadly in the scientific community. Fundamental research is distinguished from research that results in information that is restricted for proprietary reasons or national security reasons pursuant to specific U.S. government access and dissemination controls. However, University research is not considered fundamental research if:

1. The University accepts any restrictions on publication of the research results, other than limited prepublication reviews by research sponsors to prevent inadvertent disclosure of the sponsor's proprietary information or to insure that publication will not compromise patent rights of the sponsor;

2. The research is federally funded and specific controls over the access to and or dissemination of the research results have been contractually accepted by the university; or

3. Forbids participation of foreign persons.

I. **Fundamental Research Exclusion (FRE). FRE** provides that technology or software that arises during, or results from, fundamental research and is intended to be published is excluded from the export control regulations.

J. **Hardware.** Any article, material, or supply except technology and software.

K. **License.** A document bearing the word "license" issued by the Directorate of Defense Trade Controls or its authorized designee which permits the export or temporary import of a specific defense article or defense service.

~~F.~~

L. **Publicly Available.** Information that falls within any one of the following categories: Information or software that is or will be "published"; Information that arises during or results from fundamental research; Educational information; or Information in certain patent applications such as a patent application being sent to a foreign country to obtain the signature of an inventor who is a co-inventor with a person residing in the United States.

M. **Reexport.** An actual shipment or transmission of items subject to export regulations from one foreign country to another foreign country. For the purposes of the EAR, the export or reexport of items subject to the EAR that will transit through a country or countries to a new country, or are intended for reexport to the new country, are deemed to be exports to the new country.

~~G. fundamental research if:~~

~~H. The University accepts any restrictions on publication of the research results, other than limited prepublication reviews by research sponsors to prevent inadvertent disclosure of the sponsor's proprietary information or to insure that publication will not compromise patent rights of the sponsor;~~

~~I.~~

~~J. The research is federally funded and specific controls over the access to and or dissemination of the research results have been contractually accepted by the university; or~~

~~K. Forbids participation of foreign persons.~~

~~L. **Hardware.** Any article, material, or supply except technology and software.~~

~~M. **License.** A document bearing the word "license" issued by the Directorate of Defense Trade Controls or its authorized designee which permits the export or temporary import of a specific defense article or defense service.~~

~~N. **Publicly Available.** Information that falls within any one of the following categories: Information or software that is or will be "published"; Information that arises during or results from fundamental research; Educational information; or Information in certain patent applications such as a patent application being sent to a foreign country to obtain the signature of an inventor who is a co-inventor with a person residing in the United States.~~

~~O.~~

~~P. **Reexport.** An actual shipment or transmission of items subject to export regulations from one foreign country to another foreign country. For the purposes of the EAR, the export or reexport of items subject to the EAR that will transit through a country or countries to a new country, or are intended for reexport to the new country, are deemed to be exports to the new country.~~

~~Q.~~N. **Software.** A collection on one or more programs or microprograms fixed in any tangible medium of expression.

~~R.~~O. **Technical Data or Technology.**

1. **As defined in the EAR**, 15 C.F.R. § 772~~**772.1** –~~ information necessary for the 'development,' 'production,' 'use,' operation, installation, maintenance, repair, overhaul, or refurbishing …of an item." This includes the following, which can be in tangible or intangible form: written or oral communications, blueprints, drawings, photographs, plans, diagrams, models, formulae, tables, engineering designs and specifications, computer-aided design files, manuals or documentation, electronic media or information revealed through visual inspection."

~~1. Technology is the specific information necessary for the "development", "production", or "use of a product.~~

2. **As defined in the ITAR**, 22 C.F.R. § 120.10 ~~**120.10** – technology is~~ information required for design, development, production, manufacture, assembly, operation, repair, testing, maintenance, or modification of ~~controlled~~ defense articles. This includes:

   - information in the form of blueprints, drawings, photographs, plans, instructions or documentation.
   - Classified information relating to defense articles and defense services . . .;
   - Information covered by an invention secrecy order; or

- Software . . . directly related to defense articles.

This definition *does not* include the following:

P. information concerning general scientific, mathematical, or engineering principles commonly taught in schools, colleges, and universities,

Q. information in the public domain, or

R. basic marketing information on function or purpose or general system descriptions of defense articles.

~~S.~~

~~T. **EAR.** Export Administration Regulations (Department of Commerce), which are available at 15 C.F.R. Parts 730-774.~~

~~U. **ITAR.** International Traffic in Arms Regulations, available at 22 C.F.R. Parts 120-130.~~

~~V.~~S. **OFAC.** U.S. Department of Treasury, Office of Foreign Assets Control Sanctions Program and Country, available at http://www.treasury.gov/about/organizational-structure/offices/Pages/Office-of-Foreign-Assets- Control.aspx.

V. Procedures, Approvals/Responsibilities

The President or President's designee (Vice President for Research) shall create procedures in furtherance of this policy to govern sponsored research activities.

Attachment(s)	NA

FLORIDA A&M UNIVERSITY

Board of Trustees
INFORMATION ITEM

Academic and Student Affairs Committee

Wednesday, June 1, 2022
Agenda Item: X

Subject: Student Affairs Update

Background Information and Summary: An update on the Division of Student Affairs.

FLORIDA A&M UNIVERSITY

Board of Trustees
INFORMATION ITEM

Academic and Student Affairs Committee
Wednesday, June 1, 2022
Agenda Item: XI

Subject: Academic Affairs Update

Background Information and Summary: An update on the Division of Academic Affairs.