ANNUAL REPORT
FY 2023—2024

Center for Manufacturing Research

College of Engineering

Tennessee Tech University

Center for Manufacturing Research
Moving Technology Forward

College of Engineering
TENNESSEE TECH

About the Cover

(Upper Left Photo)
Names: (Left to right) Bernard Arhin, Andrew Travis, Cody Innis
Description: Bernard, Andrew, and Cody are standing next to a battery pack designed to power a mobile level 2 EV charging station for the SMART project. The charger will be placed within an enclosed trailer with solar panels mounted on the top and side. This charger will be taken to rural areas where the current infrastructure may not allow for EV chargers to be easily installed.

(Bottom Right Photo)
Names: (Left to right) Caleb Dunlap, Cody Innis, Andrew Travis, Dr. Pingen Chen.
Description: Caleb, Cody, Andrew, and Dr. Chen are in the TTU battery testing warehouse, standing in front of a hybrid F-250 which has been successfully charged with a level 2 EV charger developed by Dr. Chen and his team for the SMART project. The truck will be used to tow their mobile EV charging system to rural areas where the current infrastructure may not allow for EV chargers to be easily installed.

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Tennessee Technological University
Center for Manufacturing Research
Annual Report – FY 2023 – 2024

Mission Statement
(Unchanged since 2001)

"To advance and support scientific and engineering knowledge in areas related to manufacturing through fundamental research and technology transfer activities, and to impact the instructional program in those areas."

The Center for Manufacturing Research (CMR) at TTU was established in 1984 and named a THEC Established Center of Excellence in 1990.

Director

Ying Zhang, Ph.D.
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Tennessee Tech University
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Cookeville, TN 38505
Phone: (931) 372-3362
www.tntech.edu/cmr/

CMR External Advisory Board

Dr. Abhijeet Borole – Electro-Active Technologies, Knoxville, TN
Thomas Lawson – Nissan North America, Decherd, TN
Brad Long – Atmus Filtration Technologies, Cookeville, TN
Jonathan Miller – Aerojet Ordnance Tennessee, Jonesborough, TN
Dr. Richard Mu - TSU Interdisciplinary Graduate Engineering Research Institute, Tennessee State University, Nashville, TN
David Nesbitt – Applied Thermal Coatings, Chattanooga, TN
Robert Wiseman – Lochinvar LLC, Lebanon, TN

CMR Faculty and Staff

Brian Bates, Senior R&D Engineer
Michelle Davis, Grants Administration Specialist II
Dr. Brandon England, Postdoctoral Research Associate
Dr. Mingyang Gong, Postdoctoral Research Associate
Dr. Nan (Terry) Guo, Assistant Research Professor
Karen Harris, Financial Analyst
Lisa Hoane, Grants Analyst
Suzanne Henry, Center Manager
Giovanni Mainardi Neto, R&D Engineer
Tyson Matheney, R&D Engineer
Micah Midgett, Lab Manager
Tammy Martin, Financial Associate (part-time, temporary)
Darlene Wiegand, Financial Analyst (part-time, temporary)

CMR Faculty Associates*

Dr. Ali Alouani, ECE
Dr. Steven Anton, ME
Dr. Pedro E. Arce, ChE
Dr. Andrea Arce-Trigatti, Curriculum & Instruction
Dr. Indranil Bhattacharya, ECE
Dr. J. W. Bruce, ECE
Dr. Stephen Canfield, ME
Dr. Nan Chen, ECE
Dr. Pingen Chen, ME
Dr. George Chitiyo, Curriculum & Instruction
Dr. William Eberle, CS
Dr. Ismail Fidan, MET
Dr. Manaak Gupta, CS
Dr. Syed Rafay Hasan, ECE
Dr. Ada Haynes, Sociology & Political Science
Dr. Stephen Idem, ME
Dr. Bruce Jo, ME
Dr. Duckbong Kim, MET
Dr. Ethan Languri, ME
Dr. Allen MacKenzie, ECE
Dr. Mohamed Mahmoud, ECE
Dr. Joseph Ojo, ECE
Dr. Andy Pardue, ME
Dr. Darek Potter, STEM
Dr. Mohan Rao, ME
Dr. Syed Ali Asad Rizvi, ECE
Dr. Rory Roberts, ME
Dr. Jonathan (Robby) Sanders, ChE
Dr. Susmit Shannigrahi, CS
Dr. Holly Stretz, ChE
Dr. Doug Talbert, CS
Dr. John Tester, GBE
Dr. Ahmedreza Vaselbehagh, ME
Dr. L. (Fred) Vondra, MET
Dr. Chris Wilson, GBE, ME
Dr. Peng Zhang, ME
Dr. Jiahong (John) Zhu, ME

* CMR Faculty Associates are TTU faculty members who work with the CMR by serving as principal investigators, co-principal investigators, or other senior personnel on externally-funded projects, as well as by submitting proposals to seek external funding.

EXECUTIVE SUMMARY

FY23-24 was a landmark year for the Center for Manufacturing Research (CMR), as it again shattered previous records for external funding in sponsored research. The CMR secured over $8.2M in activated research funding from various agencies (excluding cost-share contributions from external collaborators). This achievement represents double the activations of FY22-23 and an impressive increase of nearly 320% over the previous five-year average, marking the highest funding level since the Center's inception in 1984. We are deeply indebted to the State's unwavering support; in return, for every public dollar invested in the CMR, we have generated a 4.6-fold yield in external funding.

As always, the dedication and hard work of our talented faculty have been instrumental in achieving such substantial funding levels in competitive grants, enabling the CMR to "**be regionally and nationally competitive through creative & collaborative research in advanced manufacturing**," a vision articulated by the Center five years ago. As TTU aims to double sponsored research funding by 2025, the CMR's accomplishments have also significantly contributed to the University's efforts in achieving its research goal. This summary provides insight into three newly activated projects, offering a snapshot of the faculty's research endeavors. Descriptions of other research projects can be found in the "*Research Highlights*" section.

Following several successful proposals in the past, Dr. Pingen Chen and his team received another award from the Department of Energy (DOE), totaling over $9.2M ($4,531,642 sponsor share + $4,671,076 cost share), for the proposal titled "Second-life Battery in Mobile EV Charging Application for Rural Transportation (SMART)." The project aims to address the urgent need to develop affordable mobile charging stations that can be deployed at scale in rural America by utilizing second-life batteries retired from electric vehicles. Undergraduate and graduate students will have the opportunity to work with industry partners such as Nissan North America, Envision AESC (a leading battery manufacturer), mobile charging station manufacturers, as well as battery testing and recycling companies to gain critical knowledge of lithium-ion batteries. The project will create and demonstrate the first-of-its-kind affordable, resilient, and sustainable rural EV infrastructure in a multi-state region (TN, OH, VA, KY, WV, KS, and TX).

Drs. Syed Rafay Hasan, Terry Guo, and Doug Talbert received a grant of $2,643,776 from NEYA Systems (a division of Applied Research Associates, Inc.) to research hardware security for autonomous ground vehicles. Physical-layer-level attacks on sensors pose a serious challenge for autonomous vehicle infrastructure. Eight graduate students, one postdoc, and several undergraduate students will be engaged in this research to address the critical issues in potential sensor attacks to enhance infrastructure safety for autonomous vehicles. The team will also develop an Autonomous Vehicle Security Research Lab for sustained research in this area.

Drs. John Zhu and Ying Zhang were awarded $1.25M ($1,000,000 sponsor share + $255,743 cost share) by the DOE to work on "Spray Deposition of Coal-Derived Graphene-Copper Nanocomposites for Advanced Conductors." The team will focus on manufacturing copper-graphene nanocomposites with properties that surpass those of the copper wires and cables

currently used in various clean energy applications. Coal-derived graphene will also be incorporated into the composites, aiming to repurpose coal and coal waste to develop low-cost advanced conductors.

During FY23-24, a total of $8,219,594 in external funding was activated, with an additional $2,567,828 in cost share from both external and internal contributors. CMR Faculty Associates submitted 27 research proposals, collectively valued at over $30.6M. The high caliber of the faculty's research is evident in their scholarly output, which includes 59 journal articles, 67 conference papers, 11 book chapters, and one U.S. patent.

CMR Faculty Associates remain committed to training the next generation of the manufacturing workforce. In FY23-24, CMR supported a total of 70 graduate students (26 M.S. and 44 Ph.D. students), including 6 M.S. and 7 Ph.D. students from underrepresented minorities. A historically high level of external funding ($946,181) was dedicated to supporting graduate students, nearly doubling the amount from FY22-23. Additionally, CMR provided support for 22 undergraduate research assistants through both State Appropriations and externally funded projects.

The CMR strives to serve the community and make a greater impact. The Industrial Training and Assessment Center (ITAC, previously known as IAC), led by Dr. Ethan Languri, conducted energy assessments for 17 manufacturers in three states. Since its inception in 2006, the ITAC has conducted over 315 energy assessments, leading to $112.6 million in persistent cost savings for industry. This represents a reduction of 0.8 million metric tons of CO_2 greenhouse gases. In FY23-24, in addition to supporting students and researchers from various groups and departments on over 40 projects, the CMR Materials Science Laboratory (MSL) provided laboratory and research experience to Upper Cumberland high school teachers through a summer program. Moreover, Dr. Ismail Fidan instructed high school and community college STEM teachers in Tennessee and Kentucky in the pedagogy of additive manufacturing to prepare their students for the modern manufacturing workforce.

Center Research, Education and Outreach Areas

Smart Manufacturing, including (1) Additive Manufacturing, (2) Advanced Robotics and Smart Mobility, and (3) Cybersecurity in Manufacturing.

Sustainable Materials and Manufacturing, including (1) Materials Processing and Modeling and (2) Energy Conversion / Storage Materials and Systems.

Industry Support, including efforts to provide Tennessee manufacturers with technical expertise in problem-solving challenges faced in materials, design, testing, and processes.

Education and Outreach, including efforts to enhance the Tennessee workforce development and outreach in the CMR's research areas in addition to such other activities as energy efficiency, waste reduction, and productivity improvements.

Selected Highlights from FY 2023 – 2024

CMR Faculty Associates were funded for a total of $8,219,594 from various funding agencies (e.g., National Science Foundation, U.S. Department of Energy, NASA, National Institute of Health).

CMR's new matching funds for the past FY were $6,807,610. This amount excludes $1,417,814 of indirect costs associated with this year's funded projects.

Twenty-seven research proposals totaling $30,860,258 were submitted by CMR faculty and faculty associates.

CMR supported 70 graduate students during the past FY. A total of 26 M.S. students and 44 Ph.D. students were funded through both State appropriations and external funding received by faculty. Specifically, external grants funded 15 of the M.S. students and 24 of the Ph.D. students. Thus, 59% of CMR graduate students supported was from external funding. Among the graduate students funded by CMR, 6 M.S. and 7 Ph.D. students were from underrepresented minorities.

Eight M.S. students and five Ph.D. students supported by CMR received their degrees during FY23-24.

CMR supported a total of 22 undergraduate research assistants during this past fiscal year through both State Appropriations and externally-funded projects.

CMR Faculty Associates and R&D engineers have published 59 journal papers, 67 conference papers, 11 book chapters, and one patent during the past year.

Table 1. Summary of CMR Accomplishments

	FY 18-19	FY 19-20	FY 20-21	FY 21-22	FY 22-23	FY 23-24
Total External Activations	$2,090,724	$2,411,429	$2,185,133	$2,085,716	$4,141,124	$8,219,594
Number of Graduate Students Supported by External Funding and State Appropriations	33	36	41	53	55	70
Percentage of Graduate Students Supported by External Funding	55%	53%	59%	38%	53%	59%
Number of Undergraduate Students Supported by External Funding and State Appropriations	46	35	50	41	18	22

Table 1 summarizes CMR accomplishments in the past six years. A brief description of some of these funded projects can be found in the “Research Highlights” on pages 12-15.

The Center’s annual external activations (FY13-14 to FY23-24) are presented in Figure 1. The proposals submitted by the CMR Faculty Associates (FY13-14 to FY23-24) are shown in Figure 2.

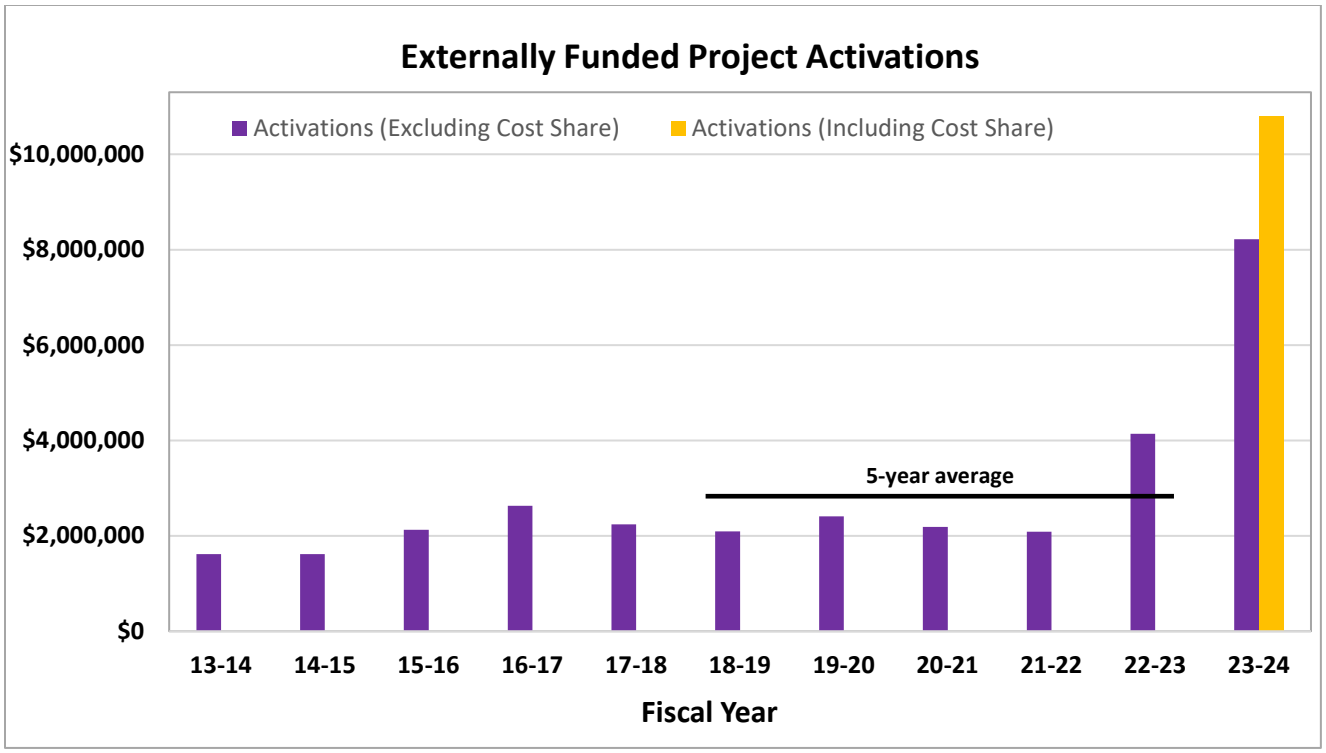


Figure 1 – Externally Funded Activations Since FY13-14

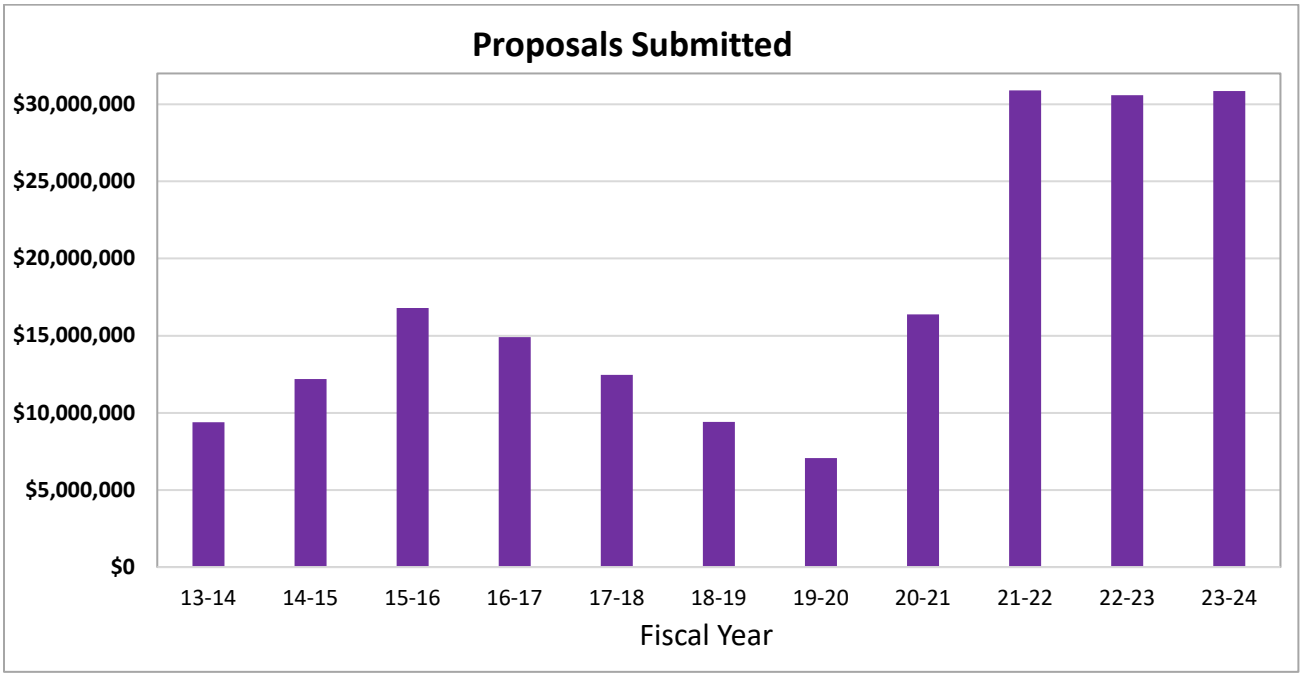


Figure 2 – Proposals Submitted Through CMR Since FY13-14

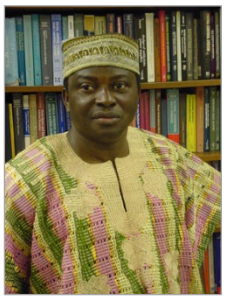
Table 2 shows various sources of external revenues for the past seven years that were used to “release” or “free up” State appropriations for other strategic investment areas.

Table 2. Salary and Supplies Released by External Funding

Performance Metrics	FY 17-18	FY 18-19	FY 19-20	FY 20-21	FY 21-22	FY 22-23	FY 23-24
CMR faculty and staff release time	$101,464	$86,717	$129,844	$155,410	$80,066	$107,517	$172,383
Graduate student stipend and fees from external sponsors	$428,579	$287,144	$157,179	$294,022	$431,500	$494,940	$946,181
Total of income resources (F&A return, testing income, GRA support, equipment usage, and release time)	$614,388	$412,454	$304,220	$472,841	$542,281	$618,667	$1,124,394

Research Highlights

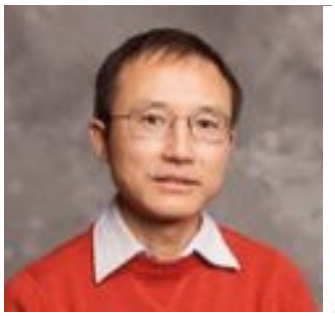




Dr. Pingen Chen (PI, Mechanical Engineering) and **Dr. Nan Chen** and **Dr. Joseph Ojo** (co-PIs, Electrical and Computer Engineering) were awarded over $9.2M ($4,531,642 sponsor share + $4,671,076 cost share; Year 1 Activation $1,774,944) by the Department of Energy (DOE) for the project “Second-life Battery in Mobile EV Charging Application for Rural Transportation (SMART).” Mobile charging stations play a critical role in removing the charging deserts in rural areas and alleviating range anxiety, as they can be transported to desired locations for EV charging with fewer concerns about power infrastructure and locational constraints. While rural America will potentially need many mobile charging stations to eliminate charging deserts, the high investment cost due to large and new battery energy storage systems and low utilization rate are barriers to adoption at a large scale. This project aims to address the urgent need to develop affordable mobile charging stations that can be deployed in rural America at scale by utilizing second-life batteries retired from electric vehicles, which cost 70-75% less than new battery energy storage systems of the same size. Undergraduate and graduate students will have the opportunity to work with industry partners such as Nissan North America,

Envision AESC (the leading battery manufacturers in the U.S.), mobile charging station manufacturers, as well as battery testing and recycling companies to gain critical knowledge of lithium-ion batteries. The project will create and demonstrate the first-of-its-kind affordable, resilient, and sustainable rural EV infrastructure in a multi-state region (TN, OH, VA, KY, WV, KS, and TX).

Additionally, Dr. Pingen Chen (Mechanical Engineering) received $1,300,951 in activation from DOE (a grant awarded last year) for the project “Rural Reimagined: Building an EV Ecosystem and Green Economy for Transforming Lives in Economically Distressed Appalachia”. This research seeks to contribute to the building of the clean energy economy in rural areas and provide clean and affordable mobility options to underserved communities.


Dr. Syed Rafay Hasan (Electrical and Computer Engineering)**, Dr. Terry Guo** (Center for Manufacturing Research)**, and Dr. Doug Talbert** (Computer Science) received a new grant of $2,643,776 from NEYA Systems (a division of Applied Research Associates, Inc.) to tackle security in autonomous vehicle infrastructure. Physical-layer-level attacks on sensors pose a serious challenge to autonomous vehicle infrastructure. These attacks affect the overall navigational control system, AI, and communication of connected vehicles, which will be investigated in the project. Eight graduate students, one postdoc, and several undergraduate students will be engaged in this research to address critical issues related to potential sensor attacks to enhance infrastructure safety for autonomous vehicles. The team will also develop an Autonomous Vehicle Security Research Lab for sustained research in this area.

Dr. Duckbong Kim (Manufacturing and Engineering Technology) received $118,883 in Year 3 activation for his NSF-CAREER Award (total $526,186) to continue research in the additive manufacturing of high-temperature alloys capable of withstanding harsh environments such as rocket engines, high-temperature furnaces, and electronic components. Dr. Kim and his graduate students are developing a methodology to successfully fabricate titanium-zirconium-molybdenum (TZM) alloys using wire+arc additive manufacturing. The project also enables him to equip Tech’s students with cutting-edge skills in emerging, technology-intensive additive manufacturing and data science and facilitates undergraduate and graduate internships at national laboratories.

Dr. Ethan Languri (Mechanical Engineering) received continued funding from the Department of Energy totaling $346,116 ($2.3M total 5 year award = $1,750,000 sponsor share + $560,026 cost share) for the project “Public-Private Partnership to Promote Efficient, Resilient and Secure Manufacturing and Workforce Development”. This award continues the recently renamed Industrial Training and Assessment Center (ITAC) which was previously known as IAC. The goals of the ITAC are: 1) assisting small and medium-sized manufacturers to become more energy efficient and reduce carbon emissions, and 2) training the next generation of energy engineers. TN Tech, together with its Satellite Center at the University of Memphis, has the only ITAC in the state of Tennessee.

In FY 2023-2024, the ITAC conducted energy assessments for 17 manufacturers in Tennessee, Arkansas, and Mississippi. One of these clients was Hutchinson Sealing, a manufacturer of automotive seals in Church Hill, TN. In the photo, Patrick Swiecichowski, Mechanical Engineering Ph.D. student, is shown checking for costly compressed air leaks during the on-site assessment. The team identified projects that will save the plant over 43% of their annual utility costs and approximately 11,679 metric tons of carbon dioxide from being released into the atmosphere (the equivalent of 2,780 gasoline-powered passenger vehicles driven for 1 year).

Since its inception in 2006, the ITAC has conducted over 315 energy assessments and saved industry $112.6 million in implemented persistent cost savings. This represents a savings of 0.8 million metric tons of CO_2 greenhouse gases.

Dr. Mohamed Mahmoud and Dr. Syed Rafay Hasan, (Electrical and Computer Engineering) received an NSF grant “REU Site: Secure and Privacy-Preserving Cyber-Physical Systems: Software and Hardware Approaches.” The first-year activation was $152,591 (total award $359,993). The site focuses on Cyber-Physical Systems (CPSs), a class of engineering systems where computation and communication networks are used to monitor and control physical components. CPSs play a major role in the design and development of modern systems and initiatives, such as smart and safe cities, self-driving cars, industrial Internet of Things (IIoT), and the smart power grid. Security breaches in CPSs can occur through software or hardware, either of which can halt critical infrastructure and reveal citizens' locations and activities, making the security of CPSs crucial for U.S. national security. The team will conduct nationwide recruitment efforts in partnership with

minority serving institutions to reach out to meritorious students from underrepresented communities. Students will be exposed to different toolsets in domains such as cryptography, graph-based anomaly detection, and convolutional neural networks.

The team led by **Dr. Rory Roberts** (Mechanical Engineering) received $1,655,113 in activation from NASA for the “CarbonLess Electric AviatioN (CLEAN)” project (total award $8,670,014 = $7,999,982 sponsor share + $670,032 cost share). Team members include Tennessee State University, The Ohio State University, University of Dayton, University of Washington – Bothell, Boeing Research & Technology, Raytheon Technologies Research Center, and Special Power Sources. This project seeks to help solve one of aviation’s key challenges for the future of commercial air travel: zero-emission aircraft by 2050. The team will explore a preliminary design for an electrified, 150-passenger aircraft that uses an ammonia-based integrated propulsion, power, and thermal management system. The research focuses on investigating, designing, and testing several components and subsystems required for a zero-emissions commercial passenger aircraft. The research team has unique testing capabilities for solid oxide fuel cell combustor (SOFCC) with a turbogenerator (TG) power generation technology under flight conditions including pressurized operation with rapid changes in load for emulated in-flight operation. SOFC-TG technology is a unique and transformative concept addressing many of the challenges faced in all-electric propulsion-based aviation. The power generation system has high part-load efficiency during cruise, high specific power density, load following capability, high-power capacity at high altitudes adapting to low temperatures and pressures, rapid startup time, and efficient thermal management.

In addition, Dr. Roberts secured $140,318 for two other projects to continue research in solid oxide fuel cells (SOFCs) for generating carbon-neutral electrical power for aircraft and space applications.

Dr. John Zhu (Mechanical Engineering) and **Dr. Ying Zhang** (Center for Manufacturing Research) received a $1.25M grant ($1,000,000 sponsor share + $255,743 cost share) from the DOE to work on “Spray Deposition of Coal-Derived Graphene-Copper Nanocomposites for Advanced Conductors.” The project aims to achieve Cu-Gr nanocomposites with properties that surpass those of copper wires and cables currently used in clean energy applications. The team will incorporate coal-derived graphene into copper-based metal matrix composites via a cost-effective spray deposition process and optimize key processing parameters and alloy compositions to improve electrical conductivity and interfacial bonding between copper and graphene particulates.

Center Activities

Materials Science Laboratory

The Materials Science Laboratory (MSL) performs microstructural, topographical imaging, and characterization for practically any solid material. A focal point of the MSL is the ultra-high resolution Field Emission Scanning Electron Microscope (FE_SEM) which is used to take nano-scale images and perform compositional analysis.

In FY 23-24, the MSL worked closely with over 40 research projects from 13 different lab groups in 6 different departments. The lab was able to assist users in characterizing polymer gels, diamond nanoparticles, concrete, porous ceramics, refractory alloys, graphene particles, 3-D printed metals, carbon nanotubes, and many other unique and novel materials. The MSL was also able to give laboratory and research experience to 6 Upper Cumberland high school teachers through a summer program.

The MSL received an overhaul to its maintenance and safety programs this year to ensure the safety of its students and the longevity of its equipment. Part of this update includes upgrading the plumbing system to trap and remove preparation waste, reorganizing the chemical stock, safely disposing of old chemicals and hazardous waste, and replacing two outdated manual grinding tables with a new dual-plate grinding/polishing station. These refinements to the MSL have improved student safety, user reliability, and environmental consideration.

Advanced Manufacturing Workforce Development

Additive Manufacturing, often called 3D Printing, has become an increasingly common manufacturing production method. As a result, industries have begun to shift their production to additive manufacturing. However, this region has a shortage in the skilled technicians needed to meet the resulting workforce demands. Also, manufacturers and potential workers in rural and underserved areas in this region might benefit from increased awareness or the advantages that additive manufacturing can provide. Tennessee Tech and Somerset Community College (Kentucky) work together to educate a new generation of qualified employees for the region's manufacturing workforce. In the photo above, Dr. Ismail Fidan (Manufacturing & Engineering Technology) instructs Tennessee and Kentucky high school and community college STEM teachers in the pedagogy of additive manufacturing to prepare their students for the modern manufacturing workforce.

CMR Staff Recognition

Suzanne Henry retired from the CMR after 33 years of service to Tennessee Tech. Suzanne began her career at TN Tech in 1991 and served in various roles, including Secretary 2/Receptionist (1991-1994), Grants Fiscal Clerk (1994-2005), Contract Compliance Assistant (2005-2016), and Manager (2016-2024). In every role she held, Suzanne demonstrated a deep commitment to performing her duties with exceptional diligence. Many faculty members benefited from her willingness to stay late to help complete proposal submissions. Her efforts and expertise contributed to the improved quality of research proposals submitted for external funding and increased the CMR's percentage of funded proposals. In 2020, she was honored with the College of Engineering's Outstanding Staff Award.

Tyson Matheney joined the CMR in 2024 as a R&D Engineer working on the NASA CLEAN project with Dr. Rory Roberts. Tyson received his degree in Manfacturing and Industrial Technology from Tennessee Tech in 2006. He has worked as an engineer in automotive, aerospace, and space product design, manufacturing, and testing.

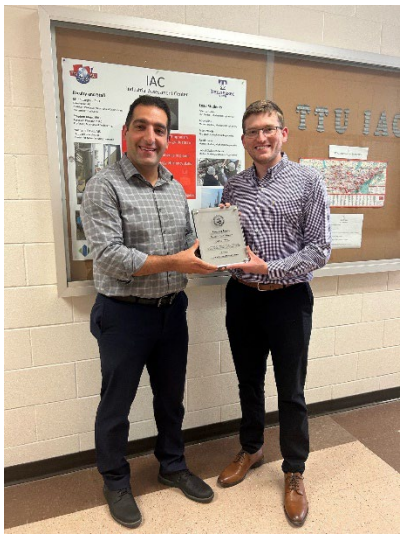
Micah Midgett graduated from Tech in 2021 and received his M.S. degree in 2023. He worked extensively with Materials Science and SEM during his graduate studies while researching SOFC interconnect materials. Micah began working full time as the MSL Lab Manager in December of 2023 and has been instrumental in introducing new users, training new students, and updating the laboratory.

Darlene Wiegand retired from the CMR after 48 years of service to Tennessee Tech. Working initially in the university's Business Office and then in the Mechanical Engineering department, Darlene joined CMR as its first permanent employee in 1984. She has held several roles in the Center, most recently as Financial Analyst. Among other accomplishments, she was honored with the TTU Outstanding Professional Award in 2011. Darlene's impact on the origination, growth, and ongoing operation of the Center is immeasurable and her dedication to the students, staff, and faculty of the CMR is appreciated and will be missed.

Faculty and Student Accomplishments and Awards

CMR Faculty Associate **Dr. Ismail Fidan** (Manufacturing & Engineering Technology) was awarded the 2024 Outstanding Faculty Award for Teaching, giving him the distinction of being recognized with awards in the areas of research, service and teaching, or the "Triple Crown" of university awards. Fidan previously received the 2020 Caplenor Research Award and the 2012 Distinguished Professional Service Award.

CMR Ph.D. student **Spencer Jones** (Mechanical Engineering) received the 2024 Outstanding Achievement in Energy Engineering by an Industrial Assessment Center Student Award from the U.S. Department of Energy for outstanding accomplishments in promoting the practices and principles of energy engineering. He is shown with his advisor, CMR Faculty Associate **Dr. Ethan Languri** (Mechanical Engineering).



CMR Faculty Associate, **Dr. Maanak Gupta** (Computer Science), received Tennessee Tech's prestigious Kinslow Engineering Research Award for his paper "From ChatGPT to ThreatGPT: Impact of Generative AI in Cybersecurity and Privacy". This award is presented each year to a faculty member for the best paper published in professional journal. Gupta's paper, of which his is principal and first author, was published August 1, 2023 in IEEE Access journal.

CMR Faculty Associate **Dr. Indranil Bhattacharya** (Electrical & Computer Engineering) was awarded the TS McCord Award for demonstrating a deep compassion for his students. This award honors a faculty member who is dedicated to their teaching and/or advising of students and have the students' welfare as top priority in all that they do.

CMR Faculty Associate **Dr. Jiahong Zhu** (Mechanical Engineering) was awarded the Leighton E. Sissom Innovation and Creativity Award, established to recognize innovation and creativity in scholarship, methodology, invention, technique, processes, or other unique contributions demonstrating creativity and innovation.

The following faculty associates received the **Wings Up 100** award, recognizing faculty who bring in $100,000 or more in external funding for student research in the previous academic year: **Dr. Pedro Arce** (Chemical Engineering), **Dr. Nan Chen** (Electrical & Computer Engineering), **Dr. Pingen Chen** (Mechanical Engineering), **Dr. Maanak Gupta** (Computer Science), **Dr. Syed Rafay Hasan** (Electrical & Computer Engineering), **Dr. Duckbong Kim** (Manufacturing & Engineering Technology), **Dr. Ethan Languri** (Mechanical Engineering), **Dr. Mohamed Mahmoud** (Electrical & Computer Engineering), **Dr. Olorunfemi Ojo** (Electrical & Computer Engineering) **Dr. Rory Roberts** (Mechanical Engineering), **Dr. Douglas Talbert** (Computer Science), **Dr. Ahmad Vaselbehagh** (Mechanical Engineering), and **Dr. Jiahong Zhu** (Mechanical Engineering).

CMR-supported students **Mohammad Alshaikh Ali** and **Shamil Gudavasov** won the Manufacturing and Engineering Technology division of the Tennessee Tech Research and Creative Inquiry Day for their paper "Experimental and Numerical Analysis of a Novel Metal Casting Process: Lost-PLA Casting".

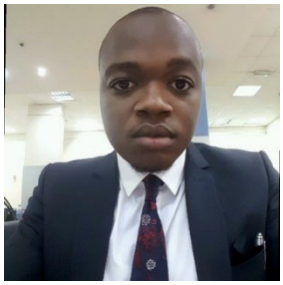
CMR-supported Ph.D. student **Oluwaseyi Ayeni** (Chemical Engineering) was honored with the Eminence Award for the Doctor of Philosophy Best Paper by the College of Engineering.

CMR-supported student **Weston Beebe** won the Electrical and Computer Engineering division of the Tennessee Tech Research and Creative Inquiry Day for his paper "Developing an Electric Vehicle Driving Dataset to Analyze Driving Behavior".

CMR-supported students **Spencer Jones** and **Atra-Niese Jones** won the Mechanical Engineering division of the Tennessee Tech Research and Creative Inquiry Day for their paper "Numerical Modeling of Industrial Thermal Management Systems for Energy Efficiency Improvements".

Select 2023 - 2024 CMR Supported Alumni

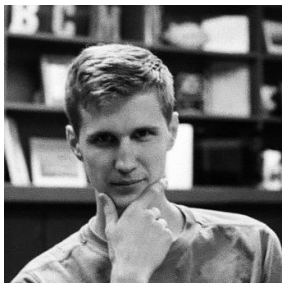
Adewale Adeyemo, Ph.D., Electrical and Computer Engineering, 2023
Quantitative Analytics Specialist
Wells Fargo
Charlotte, North Carolina



Joshua Avornyo, M.S., Electrical and Computer Engineering, 2023
Field Application Engineer
Infineon Technologies
Raleigh, North Carolina

Oluwaseyi Ayeni, Ph.D., Chemical Engineering
Chemical Engineer, R&D
Visionary Fiber Technologies
Austin, Texas

Micah Midgett, M.S., Mechanical Engineering, 2023
Materials Science Engineer
Tennessee Tech University
Cookeville, Tennessee



Jared Oliver, M.S., Mechanical Engineering, 2023
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Publications of CMR Faculty Associates & Staff

(January 2023 – December 2023)

Journal Publications

1. Abdelfattah, Sherif, Mahmoud M. Badr, Mohamed Mahmoud, Khalid Abualsaud, Elias Yaacoub, and Mohsen Guizani. "Efficient and privacy-preserving cloud-based medical diagnosis using an ensemble classifier with inherent access control and micro-payment." *IEEE Internet of Things Journal* (2023).
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Conference Publications

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External Activations

	Project Description	P.I.	Department	Total Funds
1	Foundry-Driven Change: Investigating Student Learning Engineering Education Environments with Paired Innovation-Driven and Sustainability Practices American Society for Engineering Education – Memorandum of Agreement Account #: 5-35316 1006MC	Pedro Arce	ChemE	$5,000
2	Medium-Duty eTruck: Pilot Electrified Fleets in Urban and Regional Applications UT-Austin (via DOE funds) Account #: 5-39221 852MC-Y3	Pingen Chen Stephen Canfield	ME	$121,701
3	Rural Reimagined: Building an EV Ecosystem and Green Economy for Transforming Lives in Economically Distressed Appalachia US – Department of Energy – Cooperative Agreement – DE-EE0009862 – Period 2 of 3 Account # 5-32627 907MC-Y2	Pingen Chen	ME	$1,300,951
4	Second-Life Battery in Mobile EV Charging Application for Rural Transportation (SMART) State of Tennessee Department of Environment and Conservation (TDEC) – Cost Share commitment for SMART Account # 5-33285 963-Csh	Pingen Chen Nan Chen Joseph Ojo	ME ECE ECE	$281,700
5	Second-Life Battery in Mobile EV Charging Application for Rural Transportation (SMART) Department of Energy – Award DE-EE0010404 Year 1 of 3	Pingen Chen	ME	$1,493,244
6	Additively Manufactured Lost Polymer Casting Process AFS – Memorandum of Agreement dated 06/04/2024	Ismail Fidan Fred Vondra	MET MET	$49,996
7	Collaborative Research: Sensing by Leveraging Cellular Communication Networks: A Framework of Medium Distance Baseline Interferometry National Science Foundation – Award 222586 Year 3 of 3 with supplement	Terry Guo Allen MacKenzie	CMR ECE	$77,353

	Project Description	P.I.	Department	Total Funds
8	Cybersecurity for Autonomous Vehicles: Investigation of Sensors' Vulnerability in Zero Trust Architecture Applied Research Associates, Inc. (ARA) S-G30002-84-TTU-TO2 Year 1 of 3 Account # 5-32466 979B-#1S	Terry Guo Syed Hasan	CMR ECE	$504,286
9	Defense Against Hardware Intrinsic Attacks in COTS-based Internet of Things and Futuristic Artificial Intelligence of Things Qatar University (via Qatar National Research Foundation funds) Account # 5-35310 905MC-Y1	Syed Hasan Terry Guo	ECE CMR	$33,880
10	Cybersecurity for Autonomous Ground Vehicle: Towards Hardware in the Loop Simulation for Autonomous Vehicles' Cybersecurity Applied Research Associates, Inc (ARA) S-G30002-IDIQ-86-TTU Account # 5-32465 979AG-1	Syed Hasan Terry Guo Doug Talbert	ECE CMR CSc	$1,102,818
11	Development of Human-in-the-Loop Industrial Metaverse Technology for Intelligent Advanced Manufacturing Institute for Information & Communication Technology Planning & Evaluation (IITP) in Korea Account # 5-35322 1016-Y1	Duckbong Kim	MET	$36,500
12	CAREER: Wire Arc Additive Manufacturing of Molybdenum Alloy Structures for High-Temperature Applications: Residual Stresses and Porosity Considering Ductile-to-Brittle Transition Temperature National Science Foundation – Award 2131905 – Year 3 of 5 Account # 5-31333 914MC-Y3	Duckbong Kim	MET	$118,883
13	Public-Private Partnership to Promote Efficient, Resilient and Secure Manufacturing and Workforce Development U.S. Department of Energy (DOE) – Modification of #4 – DE-EE0009722 Cooperative Agreement Account # 5-32623 901MC-M4	Ethan Languri	ME	$346,116
14	Review of Decarbonization Tools and Materials University of California – Davis (via DOE funds) Account # 5-33276 992MC	Ethan Languri	ME	$4,000

	Project Description	P.I.	Department	Total Funds
15	REU Site: CyberAI: Cybersecurity Solutions Leveraging Artificial Intelligence for Smart Systems National Science Foundation Account # 5-31356 1004-Y1	Mohamed Mahmoud	ECE	$152,591
16	Control of Modular Multi-Dual Active Bridge Converters for Integrated Ship-Board Power System Office of Naval Research Account # 5-32618 877MC-M6	Joseph Ojo	ECE	$67,500
17	Control of Modular Multi-Dual Active Bridge Converters for Integrated Ship-Board Power System Office of Naval Research Account # 5-32618 877MC-M7	Joseph Ojo	ECE	$86,453
18	Atmosphere Independent Bipropellant Consuming Additively Manufactured Solid Oxide Fuel Cells (SOFCs) for Assured On-Orbit Space Power Southwestern Ohio Council for Higher Education (SOCHE) via DOD funds RQ19-TN-20-7-AFRL2-Modification #4 Account # 5-39238 868-M4	Rory Roberts	ME	$92,000
19	Cryo Thermal Management of High-Power Density Motors and Drives Hyper Tech (via ARPA-E funds) Account #: 5-32619 884MC-P3	Rory Roberts	ME	$48,318
20	CarbonLess Electric AviatioN (CLEAN) NASA ULI – 80NSSC23M0060 – Allocation #2 for Period #1 Account # 5-32066 974-S2	Rory Roberts Bruce Jo Ahmad Vaselbehagh	ME ME ME	$200,000
21	CarbonLess Electric AviatioN (CLEAN) NASA ULI – 80NSSC23M0060 - Allocation #3 for Period #1 Account # 5-32066 974-S3	Rory Roberts Bruce Jo Ahmad Vaselbehagh	ME ME ME	$1,000,000
22	CarbonLess Electric AviatioN (CLEAN) NASA ULI – 80NSSC23M0060 - Allocation #4 for Period #1 Account # 5-32066 974-S3	Rory Roberts Bruce Jo Ahmad Vaselbehagh	ME ME ME	$455,113

	Project Description	P.I.	Department	Total Funds
23	Making Computerized Trauma Triage Decision Support Accurate, Fair and Trustworthy National Institute of Health – Award 1R15LM013824 Year 2 of 3 Account # 5-31343 929MC-Y2	Doug Talbert	CSc	$122,463
24	Spray Deposition of Coal-Derived Graphene-Copper Nanocomposites for Advanced Conductors US Department of Energy - Award DE-FE0032273 – Year 1 of 2 Account # 5-32631 967MC-Y1	Jiahong Zhu Ying Zhang	ME CMR	$518,728

External Activations in FY 2023 – 2024 $8,219,594

Schedule 7

CENTERS OF EXCELLENCE
ACTUAL, PROPOSED, AND REQUESTED BUDGET

Institution Tennessee Technological University **Center** Center for Manufacturing Research

	FY 2023-24 Actual			FY 2024-25 Proposed			FY 2025-26 Requested		
	Matching	Appropr.	Total	Matching	Appropr.	Total	Matching	Appropr.	Total
Expenditures									
Salaries									
Faculty	677,772	235,227	**912,999**	450,000	425,104	**875,104**	500,000	380,000	**880,000**
Other Professional	227,842	427,576	**655,418**	295,000	854,389	**1,149,389**	345,000	550,000	**895,000**
Clerical/ Supporting	0	18,451	**18,451**	20,000	38,355	**58,355**	20,000	0	**20,000**
Assistantships	589,752	278,004	**867,756**	700,000	442,471	**1,142,471**	510,000	425,000	**935,000**
Hourly Students	94,223	7,477	**101,700**	120,000	42,768	**162,768**	75,000	30,000	**105,000**
Total Salaries	**1,589,589**	**966,735**	**2,556,324**	**1,585,000**	**1,803,087**	**3,388,087**	**1,450,000**	**1,385,000**	**2,835,000**
Fringe Benefits	614,803	390,581	**1,005,384**	400,000	549,589	**949,589**	450,000	325,000	**775,000**
Total Personnel	**2,204,392**	**1,357,316**	**3,561,708**	**1,985,000**	**2,352,676**	**4,337,676**	**1,900,000**	**1,710,000**	**3,610,000**
Non-Personnel	**NOTE: Appropriation Expenditures in Fringe Benefits include $158,120 for Graduate Student Fees in FY 2023-24.**								
Travel	122,158	18,882	**141,040**	95,000	37,860	**132,860**	75,000	30,000	**105,000**
Computer Maint./Software	0	890	**890**	5,000	0	**5,000**	7,500	0	**7,500**
Books & Journals	0	0	**0**	0	0	**0**	0	0	**0**
Other Supplies	569,519	74,714	**644,233**	325,000	135,046	**460,046**	427,500	95,085	**522,585**
Equipment	843,273	(42,935)	**800,338**	500,000	363,132	**863,132**	575,000	105,000	**680,000**
Lab. Upgrades/Mainten.	0	2,885	**2,885**	20,000	0	**20,000**	0	0	**0**
Scholarships for Service	0	0	**0**	0	0	**0**	0	0	**0**
Subcontracts/Subawards	3,061,438	0	**3,061,438**	3,500,000	0	**3,500,000**	4,000,000	0	**4,000,000**
Renovation	0	0	**0**	0	0	**0**	0	0	**0**
Seminars/Workshops/Con	1,000	0	**1,000**	5,000	0	**5,000**	15,000	0	**15,000**
Total Non-Personnel	**4,597,388**	**54,436**	**4,651,824**	**4,450,000**	**536,038**	**4,986,038**	**5,100,000**	**230,085**	**5,330,085**
GRAND TOTAL	**6,801,780**	**1,411,752**	**8,213,532**	**6,435,000**	**2,888,714**	**9,323,714**	**7,000,000**	**1,940,085**	**8,940,085**
Revenue	**NOTE: Actual Matching Funds do not include Indirect Costs of $1,417,814 for FY 2023-24.**								
New State Appropriation	0	1,788,400	**1,788,400**	0	1,847,700	**1,847,700**	0	1,940,085	**1,940,085**
Carryover State Appropriation	0	664,367	**664,367**	0	1,041,015	**1,041,015**	0	0	**0**
New Matching Funds	6,801,780	0	**6,801,780**	6,435,000	0	**6,435,000**	7,000,000	0	**7,000,000**
Carryover from Previous Matching Funds	0	0	**0**	0	0	**0**	0	0	**0**
Total Revenue	**6,801,780**	**2,452,767**	**9,254,547**	**6,435,000**	**2,888,715**	**9,323,715**	**7,000,000**	**1,940,085**	**8,940,085**

NOTE: Out of the $1,041,015 Carryover State Appropriation in the "**FY 2024-25 Proposed Appropr.**" column, $324,738 was spent but was delayed in being posted on Banner by June 30, 2024. Another $536,729 is the cost share contribution to five DOE projects during the first fiscal quarter with $83,200 is for a temporary lab manager position. **Therefore, the actual carryover for FY23-24 is $179,546.**

FY 2025 – 2026 Budget Request and Justification

The CMR is requesting a 5.0% increase in FY 2025-26 State appropriations to further its research activities. Increased State appropriations are essential to sustaining and expanding CMR's research capabilities by allowing the Center to continue providing cutting-edge solutions, attract top talent, and contribute meaningfully to the State's economic growth.

More specifically, additional state appropriations are being requested to support the research and operational plans listed below:

- **Technical Personnel Appointment:** Lab technicians, R&D engineers, and postdocs play a crucial role in the successful execution of cutting-edge research, particularly for the large, multimillion-dollar grants recently secured by several CMR Faculty Associates. Technical personnel with specialized expertise and skills are included in CMR's hiring plan.

- **Cost-Sharing Commitment:** For large proposals (e.g., greater than $1M), funding agencies often require 20-50% cost sharing from non-federal sources. The increased core funding will enable the CMR to collaborate with industry partners and other academic units to meet cost-sharing obligations for external grants and promote new research initiatives.

- **Laboratory Upgrades:** New research initiatives, such as battery and SOFC research, impose more stringent demands on laboratory equipment to meet both safety and technological requirements. These needs cannot be fully covered by external grants and cost recovery alone. It is crucial for the CMR to allocate partial funding annually to upgrade or replace capital equipment, ensuring the maintenance of state-of-the-art research capabilities.

- **Support of Graduate and Undergraduate Research Assistants**: The requested budget increase will enable the CMR to offer competitive assistantships and continue its efforts to increase graduate student support. By providing hands-on research opportunities for both graduate and undergraduate students, the Center is preparing the next generation of highly skilled professionals who will be ready to contribute to the State's and nation's workforce.

SUPPORTING MATERIALS

CMR Supported Graduate Students Degrees Awarded in 2023-2024 Fiscal Year

Masters

Avornyo, Joshua
Fall 2023
Advisor: Dr. Ghadir Radman
Electrical and Computer Engineering

Gothard, Andrew
Fall 2023
Advisor: Dr. Steven Anton
Mechanical Engineering

Hott, Jacob
"The Design and Implementation of an Underfloor Accelerometer-Based Local Structural Dynamics Monitoring System for the Ashraf Islam Engineering Building"
Spring 2024
Advisor: Dr. Steven Anton
Mechanical Engineering

Midgett, Micah
"Reactive Element Doping and Surface Treatment for Ferritic Stainless-Steel Interconnect Performance Improvement in Solid Oxide Fuel and Electrolyzer Cells"
Fall 2023
Advisor: Dr. Jiahong Zhu
Mechanical Engineering

Mink, Abby
Spring 2024
Advisor: Dr. Sally Pardue
Mechanical Engineering

Oliver, Jared
"Functionalized Nanodiamond in Phase Change Materials for Innovative Thermal Energy Storage"
Fall 2023
Advisor: Dr. Ethan Languri
Mechanical Engineering

Patel, Parth
"Investigating Adversarial Attacks Affecting Deep Neural Network (DNN) Inference on Edge Devices: With A Comprehensive Study on Device-To-Device Collaborative DNN"
Spring 2024
Advisor: Dr. Syed Hasan
Electrical and Computer Engineering

CMR Supported Graduate Students Degrees Awarded in 2023-2024 Fiscal Year

Masters (continued)

Simpson, Noah
"Analytical Design, Experimental Testing, and Simulation of an Ejector for Anode Off-Gas Recirculation in a 1 kW Solid Oxide Fuel Cell"
Spring 2024
Advisor: Dr. Rory Roberts
Mechanical Engineering

CMR Supported Graduate Student Degrees Awarded in 2023-2024 Fiscal Year

Ph.D.

Adeyemo, Adewale
"Towards Securing Edge Intelligence in Horizontal Collaborative Environments"
Summer 2023
Advisor: Dr. Syed Hasan
Electrical and Computer Engineering

Alkunte, Suhas
"Mechanical Characterization of Functionally Graded Materials Produced by Material Extrusion Process"
Fall 2023
Advisor: Dr. Ismail Fidan
Mechanical Engineering

Ayeni, Oluwaseyi
"Two Phase Modeling of Fluid Transport in Massively Arrayed Fibrous Channels Using Computational Fluid Mechanics (CFD)"
Spring 2024
Advisor: Dr. Holly Stretz
Chemical Engineering

Brown, Katherine
"Evaluating, Explaining, and Utilizing Model Uncertainty in High-Performing, Opaque Machine Learning Models"
Summer 2023
Advisor: Dr. Doug Talbert
Computer Science

Rajeshirke, Mithila
"Fatigue Analysis of Additively Manufactured Short Carbon Fiber-Reinforced PETG Components"
Fall 2023
Advisor: Dr. Ismail Fidan
Mechanical Engineering

CMR Graduate Students Supported from State Appropriations in 2023-2024 Fiscal Year

Masters

Avornyo, Joshua
Advisor: Dr. Olorunfemi Ojo
Electrical and Computer Engineering

Beebe, Weston
Advisor: Dr. J.W. Bruce
Electrical & Computer Engineering

Bowen, Craig
Advisor: Dr. Pingen Chen
Mechanical Engineering

El-Shazly, Amr
Advisor: Dr. William Eberle
Computer Science

Hott, Jacob
Advisor: Dr. Steven Anton
Mechanical Engineering

Khallil, Md Ebrahim
Advisor: Dr. Nan Chen
Electrical and Computer Engineering

Mahmudov, Mushfig
Advisor: Dr. Ismail Fidan
Manufacturing and Engineering Technology

Midgett, Micah
Advisor: Dr. Ying Zhang
Mechanical Engineering

Phillips, Kate
Advisor: Dr. Doug Talbert
Computer Science

San Inocencio, Julian
Advisor: Dr. Jiahong Zhu
Mechanical Engineering

Tharpe, Alex
Advisor: Dr. Rory Roberts
Mechanical Engineering

Ph.D.

Adeleke, Abayomi
Advisor: Dr. Robby Sanders
Chemical Engineering

Adeyemo, Adewale
Advisor: Dr. Syed Hasan
Electrical and Computer Engineering

Alkunte, Suhas
Advisor: Dr. Ismail Fidan
Mechanical Engineering

Arogunjo, Ezekiel
Advisor: Dr. Olorunfemi Ojo
Electrical and Computer Engineering

Ayeni, Oluwaseyi
Advisor: Dr. Holly Stretz
Chemical Engineering

Barritt, Elijah
Advisor: Dr. Ahmad Vaselbehagh
Mechanical Engineering

Dunlap, Caleb
Advisor: Dr. Pingen Chen
Mechanical Engineering

Gothard, Andrew
Advisor: Dr. Steven Anton
Mechanical Engineering

Hines, Brandon
Advisor: Dr. Steven Anton
Mechanical Engineering

Imeri, Astrit
Advisor: Dr. Chris Wilson
Mechanical Engineering

Innis, Cody
Advisor: Dr. Pingen Chen
Mechanical Engineering

CMR Graduate Students Supported from State Appropriations in 2023-2024 Fiscal Year

(continued)

Ph.D.

Islam, Md Azizul
Advisor: Dr. Bruce Jo
Mechanical Engineering

Jones, Spencer
Advisor: Dr. Ethan Languri
Mechanical Engineering

Karim, Md Abdul
Advisor: Dr. Duckbong Kim
Mechanical Engineering

Raju, Md Abdul Goni
Advisor: Dr. Duckbong Kim
Mechanical Engineering

Rashid, Mamunur
Advisor: Dr. Nan Chen
Electrical & Computer Engineering

Rashvand, Mehrdad
Advisor: Dr. Ethan Languri
Mechanical Engineering

Shoummo, Md Mashiur
Advisor: Dr. Bruce Jo
Mechanical Engineering

Swiecichowski, Patrick
Advisor: Dr. Ethan Languri
Mechanical Engineering

Tanvir Hossain, Gazi Md.
Advisor: Dr. Duckbong Kim
Mechanical Engineering

Upama, Samina
Advisor: Dr. Bruce Jo
Mechanical Engineering

CMR Graduate Students Supported from External Funds in 2023-2024 Fiscal Year

Masters

Chumney, Sam
Advisor: Dr. Rory Roberts
Mechanical Engineering

Edwards, Tyler
Advisor: Dr. Jiahong Zhu
Mechanical Engineering

Layhew, Griffin
Advisor: Dr. Rory Roberts
Mechanical Engineering

Mahmoud, Marim Elhanafy
Advisor: Dr. Syed Hasan
Electrical and Computer Engineering

Meacham, Jimmy
Advisor: Dr. Rory Roberts
Mechanical Engineering

Oliver, Jared
Advisor: Dr. Ethan Languri
Mechanical Engineering

Owu, Taiye
Advisor: Dr. Olorunfemi Ojo
Electrical and Computer Engineering

Patel, Parth
Advisor: Dr. Syed Hasan
Electrical and Computer Engineering

Sakib, Tahmid Hasan
Advisor: Dr. Syed Hasan
Electrical and Computer Engineering

Simpson, Noah
Advisor: Dr. Rory Roberts
Mechanical Engineering

Solanki, Abhijeet
Advisor: Dr. Syed Hasan
Electrical and Computer Engineering

Ph.D.

Abdulmagued, Magdy
Advisor: Dr. Pingen Chen
Mechanical Engineering

Al Amiri, Wesam
Advisor: Dr. Allen MacKenzie
Electrical and Computer Engineering

Ayeni, Oluwaseyi
Advisor: Dr. Holly Stretz
Chemical Engineering

Brown, Katherine
Advisor: Dr. Doug Talbert
Computer Science

Elgarhy, Islam
Advisor: Dr. Mohamed Mahmoud
Electrical and Computer Engineering

Ellicott, Andrew
Advisor: Dr. Rory Roberts
Mechanical Engineering

Elsayed, Abdelrhman
Advisor: Dr. Olorunfemi Ojo
Electrical and Computer Engineering

Femi-Oyetoro, James
Advisor: Dr. Bruce Jo
Mechanical Engineering

Gudavasov, Shamil
Advisor: Dr. Ismail Fidan
Mechanical Engineering

Islam, Saiful
Advisor: Dr. Duckbong Kim
Mechanical Engineering

Jadhav, Sainand
Advisor: Dr. Duckbong Kim
Mechanical Engineering

CMR Graduate Students Supported from External Funds in 2023-2024 Fiscal Year

(continued)

Masters

Tai, Chern Chao
Advisor: Dr. Doug Talbert
Computer Science

Travis, Andrew
Advisor: Dr. Pingen Chen
Mechanical Engineering

Tungar, Nikita
Advisor: Dr. Ethan Languri
Mechanical Engineering

Xu, Wenwen
Advisor: Dr. Pingen Chen
Mechanical Engineering

Ph.D.

Joshi, Sachin
Advisor: Dr. Pingen Chen
Mechanical Engineering

Kamal, Moumita
Advisor: Dr. Doug Talbert
Computer Science

Kramer, Trevor
Advisor: Dr. Rory Roberts
Mechanical Engineering

Lamantia, Maxavier
Advisor: Dr. Pingen Chen
Mechanical Engineering

Mahdi, Mohammad
Advisor: Dr. Duckbong Kim
Mechanical Engineering

Malik, Muhammad Ali Ijaz
Advisor: Dr. Pingen Chen
Mechanical Engineering

Mansour, Mohamed
Advisor: Dr. Olorunfemi Ojo
Electrical and Computer Engineering

Nevills, Miles
Advisor: Dr. Ethan Languri
Mechanical Engineering

Rajeshirke, Mathila
Advisor: Dr. Ismail Fidan
Mechanical Engineering

Saha, Achintya
Advisor: Dr. Bruce Jo
Mechanical Engineering

CMR Graduate Students Supported from External Funds in 2023-2024 Fiscal Year

(continued)

Ph.D.

Schafer, David
Advisor: Dr. Rory Roberts
Mechanical Engineering

Shuaibu, Musayyibi
Advisor: Dr. Olorunfemi Ojo
Electrical and Computer Engineering

Su, Zifei
Advisor: Dr. Pingen Chen
Mechanical Engineering

External Funding – Proposals Submitted

	Status	Title	P.I.	Dept.	Total Funds
1	1000MC	ERI: Microalloying and Strain Hardening to Improve the Mechanical Behavior and Fatigue Life of Zamak 12 Before and After Adding Tantalum National Science Foundation	Hussein	BE	$195,828
2	1001MC	MRI: Track 1 Development of an Instrument for Dynamic Smart Infrastructure Research (DySIR) National Science Foundation	Anton Henderson Shannigrahi	ME CEE CSc	$1,391,209
3	1002MC	Applied Research Experience for Technician Education in Additive Manufacturing for Competitiveness in the United States (AMTechEd4C) National Science Foundation	Fidan Kim	MET MET	$646,179
4	5-35465 1003MC	Additively Manufactured Lost Polymer Casting Process AFS – Memorandum Agreement dated 6/4/24	Fidan Vondra Alshaikh Ali	MET MET MET	$49,996
5	1004MC	REU Site: CyberAI: Cybersecurity Solutions Leveraging Artificial Intelligence for Smart Systems National Science Foundation	Mahmoud Hasan	ECE ECE	$464,997
6	1005MC	High Efficiency Solid Oxide Fuel Cell/ Turbogenerator Hybrid Electric Propulsion System Brayton Energy (via NASA funds)	Roberts	ME	$27,270
7	5-35316 1006MC	Foundry-Driven Change: Investigating Student Learning Engineering Education Environments with Paired Innovation-Driven and Sustainability Practices American Society for Engineering Education – Memorandum of Agreement	Arce	ChemE	$5,000
8	1007MC	Revolutionizing Manufacturing Training and Operations: The AI-Powered Comprehensive Manufacturing Education Initiative (AIP-CMET) Florida International University (via DOD funds)	Fidan Kim Y. Zhang	MET MET CMR	$1,929,606
9	1008MC	Self-Powered Compartmental Contact Mechanics Sensing in Total Knee Replacements National Institute of Health	Anton Van Neste	ME ECE	$2,721,670
10	1009MC	Development of a Silicon-Free Hafnon-Based Bond Coat for Next-Generation Environmental Barrier Coatings US Department of Energy	Y. Zhang Zhu	CMR ME	$799,998

	Status	Title	P.I.	Dept.	Total Funds
11	1011MC	CarbonLEss AviatioN (CLEAN) Testing and Demonstration Facility (TMF) Federal Aviation Administration	Jo P. Zhang Vaselbehagh	ME ME ME	$7,500,000
12	1012MC	Closing Loop for Rural Circular Economy (CIRCLE): Advancing End-of-Life EV Battery Recycling Department of Energy VTO	P. Chen Canfield N. Chen	ME ME ECE	$4,867,514
13	1013MC	Imitation Learning-based Knowledge Enhance Method of Autonomous Cooperative Robot for Expert Knowledge Transition in Advanced Manufacturing Pukyong National University (via National Research Foundation of Korea funds)	Kim	MET	$200,997
14	1014MC	Human-Centralized Virtual Manufacturing for Industry 5.0 Hanyang University	Kim	MET	$346,459
15	1016MC	IITP Human in the Loop Institute for Information & Communication Technology Planning & Evaluation (IITP)	Kim	MET	$146,000
16	1017MC	Partnership for Public Fleet Electrification in Tennessee U.S. Department of Energy	P. Chen N. Chen	ME ECE	$999,975
17	1018MC	Resiliency Platform for Spectrum Management Automation-Development and Field Trial National Science Foundation	Guo MacKenzie	CMR COE	$499,999
18	1019MC	South Carolina Clean Energy and Manufacturing Workforce Training and Technical Assistance U.S. Department of Energy	Languri	ME	$461,352
19	1020MC	Mobile Objective Vehicle Emulator (MOVE) U.S. Department of Defense	Anton	ME	$66,751
20	1021MC	Self-Powered In Vivo Join Load and Angle Sensing in Total Knee Replacement National Institute of Health	Anton	ME	$2,889,738
21	1023MC	Continued Enhancement of Additive Manufacturing Foundry-Grade Sand Mold U.S. Department of Defense	Fidan Vondra	MET MET	$299,259
22	991MC	Highly Efficient and Durable Low-Temperature Solid Oxide Electrolysis Cell Stack Based on Engineered Ceria Electrolyte University of North Dakota (via DOE funds)	Zhu Zhang	ME CMR	$600,430
23	993MC	Development of Low-0CTE, Additively-Manufactured Ferritic Alloys as SOEC Internnect Nexceris	Zhu Zhang	ME CMR	$600,218

	Status	Title	P.I.	Dept.	Total Funds
24	995MC	EAGER: CET: Game-Theoretic Reinforcement Learning for Energy Optimization of Datacenters with Office Occupancies National Science Foundation	Rizvi Ojo	ECE ECE	$299,899
25	996MC	Industry-Driven Educational Alignment and Learning (IDEAL) Workforce Development for Tennessee BTACs U.S. Department of Energy	Languri	ME	$1,100,000
26	998MC	Collaborative Research: Secure Integrated Sensing and Communication (S-ISAC) Networks by Exploiting Physical Characteristics and Network Collaboration National Science Foundation	Guo MacKenzie	CMR COE	$249,964
27	999MC	Rural EV Infrastructure for Sustainable Economy (RISE) U.S. Department of Energy	P. Chen N. Chen Aikens	ME ECE Research	$1,499,950

Proposals Submitted in FY 2023-2024 $30,860,258