NORFOLK STATE UNIVERSITY

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CSET Good News Report
August 2025

1. Center for Materials Research

Dr. Messaoud Bahoura, Professor of Engineering and Director of the Center for Materials Research, published research in *Scientific Reports* (Nature Publishing Group), titled *"Enhancing the cathodic performance of FeS_2 in lithium-ion batteries via sulfurization treatment"* (Scientific Report 15, 31653, 2025). This study addresses a major challenge in energy storage by improving the performance of pyrite (FeS_2) thin films, a promising and environmentally friendly cathode material for lithium-ion batteries. The research team demonstrated that sulfurization treatment significantly enhances the chemical composition, crystallinity, and long-term electrochemical performance of FeS_2 thin films. These findings provide a new pathway to advance sustainable battery technologies and highlight the innovative contributions of NSU scholars to global energy research.

Dr. Messaoud Bahoura, Professor of Engineering and Director of the Center for Materials Research, and his AI Expert Team from Old Dominion University (ODU) have been awarded a Professional Enrichment and Growth (PEG) Grant by the Office of Faculty Affairs and Professional Development at Old Dominion University. Their funded proposal, *Expert Contribution Recognition Ecosystem: Performance-Based Support for AI Research Advisory Group*, will launch the first structured AI Research Support initiative for clinicians at the Macon & Joan Brock Virginia Health Sciences Center at ODU. This groundbreaking program will connect clinical investigators from ODU and Norfolk State University (NSU) with AI experts to strengthen research methodologies in areas such as medical imaging, clinical documentation, genomics, disease modeling, and population health. By bridging clinical expertise with advanced AI applications, the initiative will enhance the institutions' ability to secure competitive extramural funding and accelerate innovations that improve patient care and health outcomes.

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MSIPP-NoVEL Consortium holds annual summer retreat at Lawrence Livermore National Laboratory, July 29 – August 2.

Forty-two NoVEL Consortium participants attended the multi-day project retreat at Lawrence Livermore National Laboratory (LLNL) in Livermore, CA. The retreat program included LLNL facility tours, technical and professional talks by LLNL staff, NoVEL-LLNL student-intern panel, research presentations by students, planning meetings, and networking and team-building activities. The group picture was taken in front of NIF, the National Ignition Facility, a three-football-field sized building which has in recent years enabled net positive fusion energy output using lasers. **Dr. Suely Black, Chemistry Professor**, CMR member and the Consortium Education and Management Director, led the event. Eighteen NSU STEM graduates and undergraduate students and six chemistry faculty and staff members joined fourteen consortium participants from Virginia State University and Elizabeth City State University, and three others from LLNL. The NoVEL Consortium, an acronym for NSU, VSU, ECSU and LLLN, explores its theme of research and education in photonics materials to provide technical and professional development activities to partnering university students. This September NoVEL, a Department of Energy Minority Serving Institution Partnership Program consortium, completes its fourth successful year. A month ago, NSU received notice of the release of the $1,000,000 annual award to NoVEL, which will enable us to continue our efforts to offer students out-of-the-classroom professional experiences.

Fig. 1: MSIPP-NoVEL Consortium group picture in front of NIF, Lawrence Livermore National Laboratory, July 2025.

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Fig. 2: NoVEL students engage with Dr. Bradley Childs, LLNL staff scientist and summer research advisor of NSU chemistry senior Asia Jones, after his talk at the retreat.

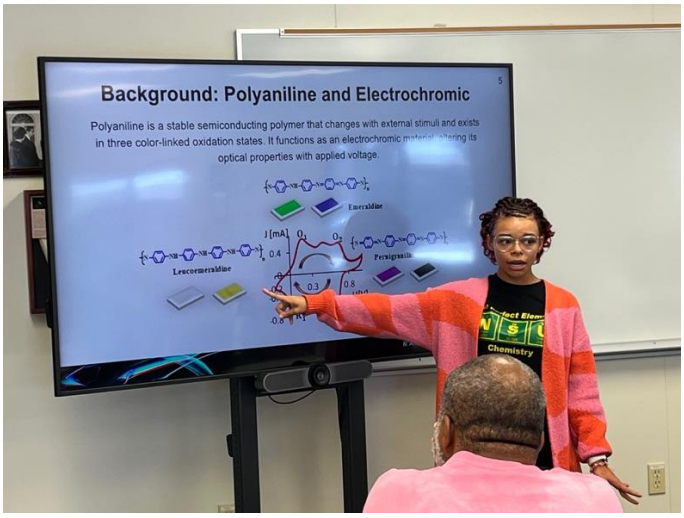

Fig. 3: **Jaycie Jenkins, NSU chemistry junior,** presents her research at LLNL as practice for her oral presentation at the SPIE annual conference, August 2025.

Fig. 4: NoVEL participants and LLNL summer research interns, Kavon Ragland (VSU), De'ja Bailey (NSU), Asia Jones (NSU), Asaya Bulgin (ECSU) and Jordan Simmons (NSU), serve as panelists sharing their insights on how to take advantage of opportunities offered by NoVEL to advance professionally.

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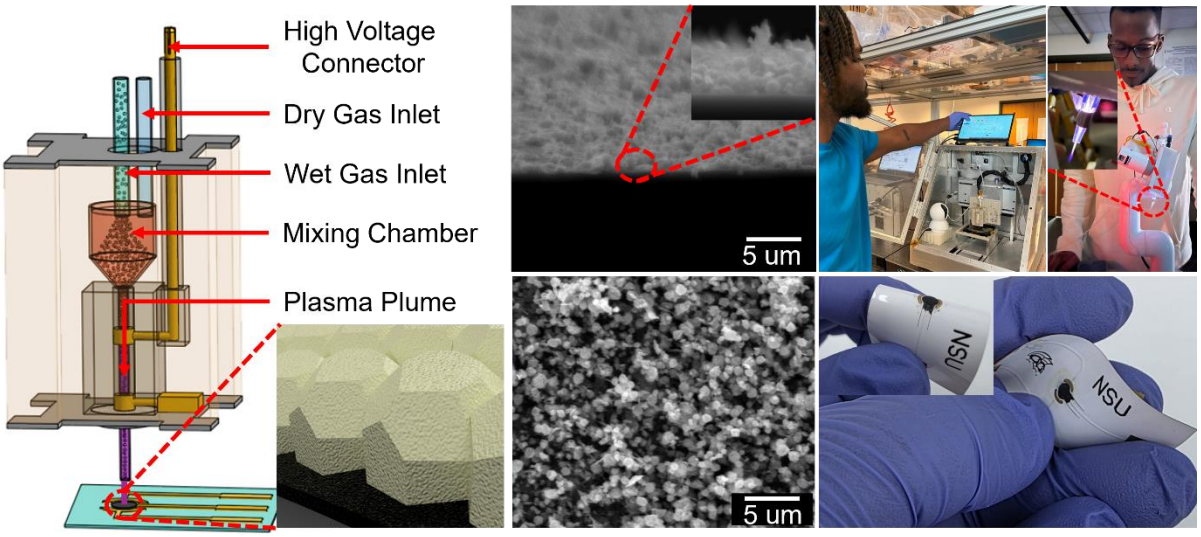
2. Department of Engineering

Scientific Reports Features Innovative Binder-Free Direct Printing Method for Wearable Electrochemical Sensing Applications

Dr. Renny Fernandez's research team has successfully published their paper, "Direct Printing of Metal Oxide Nanostructures for Wearable Electrochemical Sensing," in Scientific Reports. This work, authored by **Nithin Krisshna Gunasekaran, Harikrishnan Muraleedharan Jalajamony, Santhosh Adhinarayanan, Soumadeep De, Reven Adu, Shawn Strobel, Govindarajan Ramesh, and Renny Fernandez,** is the first to demonstrate a rapid, binder-free, direct printing method for depositing metal oxide nanostructures onto flexible substrates, enabling advanced wearable electrochemical sensing applications.

The study details a single-step plasma-assisted inkjet printing approach that combines nanoparticle deposition and plasma activation in one process. Using this method, the team successfully fabricated flexible sensing layers with ZnO for pH detection and CeO_2 for hydrogen peroxide (H_2O_2) sensing. The process operates at low temperatures and does not require any binders or post-treatment, offering a scalable and efficient route to produce durable, high-performance wearable sensors. This advancement represents a significant step toward next-generation technologies for health and environmental monitoring.

DOI: https://doi.org/10.1038/s41598-025-04426-1



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3. NSF-Funded Graduate Internship on Atmospheric Plasma Jet Printing at Space Foundry Inc.

Supplementary funding of $55,000 awarded under NSF grant #2100930- Excellence in Research: Aptamer-Integrated Graphene-Gold Conjugates for Machine Learning Aided Pesticide Residue Screening, led by **Dr. Renny Fernandez**, was used to support a six-month graduate internship at Space Foundry Inc., San Jose, California.

During this internship, graduate student Soumadeep De gained valuable hands-on experience in Atmospheric Plasma Jet Printing (APJP), focusing on the design and implementation of a feedback system to control misting of nanoparticle suspensions in real time to improve print quality. The internship significantly strengthened the research team's capabilities in plasma-based additive manufacturing and flexible electronics and contributed to expanding Norfolk State University's expertise in advanced printing technologies.