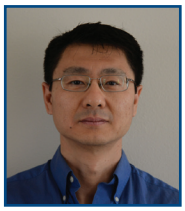
Louisiana EPSCoR
EXPERIMENTAL PROGRAM TO STIMULATE COMPETITIVE RESEARCH VOL.11 NO.1

Advanced Manufacturing & Materials Takes Center Stage in Louisiana

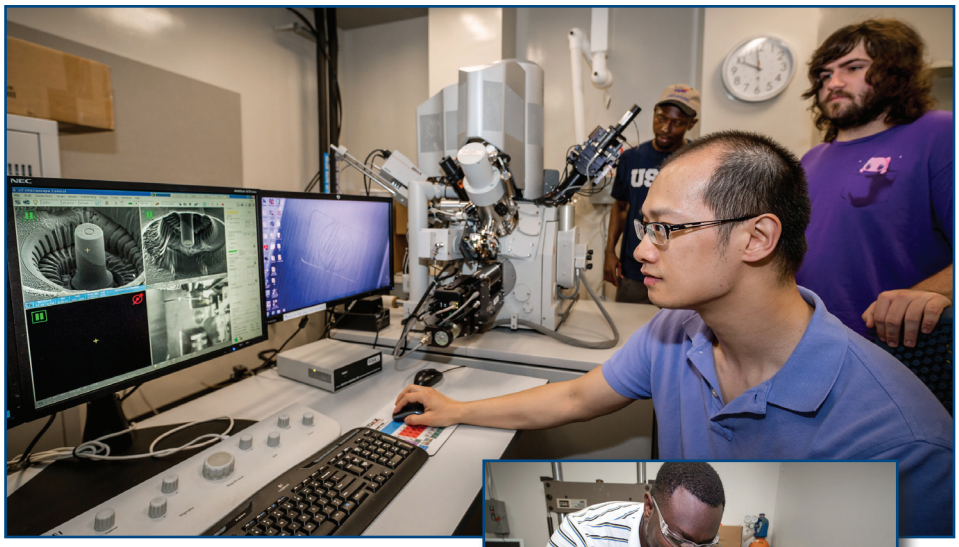
A consortium of researchers has put Louisiana's growing advanced manufacturing and materials industries into the national spotlight after being awarded a highly competitive $20 million 5-year Research Infrastructure Improvement (RII) Track-1 award from the National Science Foundation (NSF) EPSCoR Program. The award will establish the Consortium for Innovation in Manufacturing and Materials (CIMM), a research collaboration among five of Louisiana's state universities: Louisiana State University (LSU), Louisiana Tech University, Grambling State University, Southern University in Baton Rouge, and the University of New Orleans.



Dr. Wen Jin Meng

"This NSF EPSCoR award recognizes the work we have conducted in various aspects of advanced manufacturing over the past decade and offers an opportunity for us to further elevate advanced manufacturing research and development in Louisiana to national and international levels," said Dr. Wen Jin Meng, LSU technical lead and Williams Professor of Mechanical Engineering.

The CIMM consortium will research how to use nature's building blocks to manufacture high technology products, like 3D printed aerospace parts made out of exotic metals and tiny components for microdevices.



TOP: Students working with a dual-beam focused ion beam system used for micro/nano scale materials characterization and structure fabrication. Pictured: Yang Mu (LSU), Jordan Frick (LSU), and Everest Ejigiri (Southern University).

BOTTOM: Ukeamezhim Ayaugbokor (Southern University) uses a high-temperature differential scanning calorimeter to analyze process conditions for advanced composite materials.

Photographer: Eddy Perez, LSU.

Louisiana researchers and computational scientists will investigate the fundamental science behind manufacturing materials with components that you can see with the naked eye (10^{-3} meter/millimeters) and those you can't see, ranging down to the nanoscale of one billionth of a meter (10^{-9} meter/nanometers). In addition to the multiple visual scales, researchers will develop manufacturing processes that utilize multiple time scales ranging from seconds down to one billionth of a second (10^{-9} second/nanoseconds).

Studying the fundamental science of each step of the manufacturing processes at the atomic scale will help researchers understand what is happening during melting, solidification, heat conduction, microstructure formation, etc.

Laser-Based 3D Printing

Laser-based 3D printing utilizes specialized powders made out of exotic metals that are melted into layers with a laser. Early adopters include NASA and aerospace companies who are testing this technology to print metal components like rocket fuel injectors. The 3D printing process builds the metal object in one manufacturing step, drastically cutting time, labor, and materials when compared to current

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manufacturing technology which uses alloy metal sheets that are cut, hot pressed, punched, welded, and hand-brazed into shape.

"The over arching goal of CIMM is to accelerate manufacturing technology development by combining supercomputer modeling and simulation with physical experimentation. The consortium will establish a dedicated statewide Central User Facility at LSU for critical experimental infrastructure, with plans for long-term management and sustainability," said Dr. Michael Khonsari, the Associate Commissioner for Sponsored Programs Research and Development at the Louisiana Board of Regents.

"The computational research will be conducted on supercomputers through the Louisiana Optical Network Initiative (LONI) network and has tremendous advantages because many of the preliminary experiments can be conducted virtually on each campus, greatly speeding up discovery time and testing of novel materials," he continued.

Multiscale Metal Forming

Over time, technology has miniaturized and there is increasing demand for tiny metal components, like microchannel heat exchangers and miniature gas chromatographs. Microforming components in smaller dimensions bring scientific challenges due to changes in material behavior, friction and accuracy at that scale. Therefore, the engineering of the forming tool surfaces becomes essential. CIMM researchers will experiment with new coatings on microforming tools and study the effects on the atoms of the metal as it interfaces with the tools. The resulting computer modeling and materials research will guide the development of multiscale metal forming and replication technologies for mass production of microdevices.

Students at the Shared Instrumentation Facility. Photographer: Eddy Perez, LSU.

Statewide Collaborations

Partnerships will be forged with Louisiana businesses to further leverage the State's assets to educate and train the specialized workforce needed for this growing industry that heavily relies on computer technology to produce high precision products.

CIMM researchers will also help to educate and train a skilled and diversified workforce to support manufacturing industries. Through various outreach, educational and mentoring programs, researchers aim to encourage Louisiana students in all grade levels, to explore disciplines in science, technology, engineering and mathematics (STEM). An emphasis will be placed on engaging underrepresented minorities.

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