



Undergraduate, graduate, and faculty participating in the 2018 CIMM symposium at Louisiana State University

## CIMM: Consortium for Innovation in Manufacturing and Materials

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In casual conversation, the term “university” usually invokes thoughts of higher education and student advancement. However, for centuries universities have been on the frontlines of scientific discovery along with their role in education. Groundbreaking discoveries such as the atomic nucleus, nuclear power and Maxwell’s equations have all resulted from university research. The invaluable contributions of university research to academia and society do have a price, however, and universities must receive adequate funds to continue their research. In public, state-sponsored universities, a significant portion of research funds are provided in the form of National Science Foundation (NSF) grants. A grant proposal is written and selected based on the intellectual merit and broader impacts of the proposal. In August 2015, one of the largest grants in Louisiana history was proposed by the Louisiana Board of Regents on behalf of five Louisiana universities. The NSF awarded a grant of 20 million dollars to the five universities, which included Louisiana State University, Louisiana Tech University, Grambling State University, Southern University, and the University of New Orleans. The grant led to the formation of the Consortium for Innovation in Manufacturing and Materials (CIMM) to oversee the application of the grant. CIMM was founded with goals centered around research, education support and collaboration. Within each goal, several steps were laid out to measure the progress of CIMM.

CIMM covers a broad range of research topics related to advanced manufacturing methods and materials. There are two science and technology thrusts (STT) that are the primary research focuses emphasized by CIMM. The first science and technology thrust (STT1) centers around multiscale metal forming and replication-based manufacturing. In other words, STT1 research investigates the challenges of fabricating metal microstructures and how to fabricate the structures in an economic and scalable process. One example of an

STT1 funded project at Louisiana Tech University is the heat transfer performance of fabricated micro-fin arrays in a pool boiling apparatus. The second science and technology thrust (STT2) focuses on material design, processing and characterization for laser-based metal 3-D printing. One current challenge in 3-D printing metals lies in the difficulty of manufacturing the metal powder used in layer-by-layer 3-D printing. In addition, the fundamental science behind the formation of the metal parts requires further explanation.

Education outreach within Louisiana is another goal of CIMM. The outreach begins with the faculty of the five CIMM universities. New early career faculty members have been hired and mentored to conduct CIMM research. Diversity is especially important within CIMM when selecting new faculty members, graduate students and undergraduate researchers within CIMM. Undergraduate students are given the opportunity to learn and experience graduate research through the Research Experience for Undergraduates (REU) program. REU positions for CIMM research take place in the summer and give students valuable experiences in research. CIMM faculty members reach out to other educational centers such as community colleges and elementary schools throughout Louisiana. Science demonstrations and technology seminars are provided to encourage youth to pursue higher education in STEM fields.

Another goal of CIMM is to encourage the collaboration of CIMM partnered universities throughout the state. Collaboration between universities allows the participating universities to share equipment and facilities. Over twenty-five graduate researchers from seven disciplines received funding from CIMM, and projects often have multi-institutional teams of researchers from different universities. For example, the heat transfer studies on micro-fin arrays in pool boiling under the STT1 are fabricated at Louisiana State University, tested at Louisiana Tech, and predicted with computational analysis at Southern University. In addition to university collaboration, industry collaboration is encouraged by CIMM to achieve the maximum benefits of university research. Start-up companies that utilize the discoveries made by CIMM strengthen the workforce and economy of the state.

As of the 2018 CIMM symposium this past July, the Consortium is currently on schedule to meet the full potential of its goals by the grant’s completion on March 2020. Several findings have already been published by teams within the STT1 and STT2 objectives, and work continues to progress in these areas. Dozens of undergraduate and graduate students have been mentored through CIMM sponsored research, and many elementary-level students witnessed scientific demonstrations within their schools. The increased collaboration of universities has led to research that utilizes all the equipment and faculty in Louisiana’s public universities. At its current progress, CIMM will be remembered in history as a scientific push that not only funded universities but changed Louisiana for the better.