IMPACTS SUBMISSION

For division/directorate use

Please use the following template to present items that would make persuasive Impacts. Information must be understandable by a lay person.

SUBJECT: LSU capstone design program creating engineering solutions that will help boost the U.S. advanced manufacturing industry

CATEGORY- Chose U.S./global economy, national security or scientific knowledge:
U.S./global economy

NSF AWARD(S) - Provide award number hyperlink:
https://nsf.gov/awardsearch/showAward?AWD_ID=1541079

OTHER SUPPORTING INFORMATION:

BRIEF SUMMARY OF OUTCOMES - (Why is this award compelling for use as an Impact?):
Selective laser melting (SLM) is a rapidly developing technology in the advanced manufacturing industry for producing precision parts with complex shapes out of metal alloys. Research is needed to address the scientific challenges that remain, so the U.S. can realize the full potential of this growing industry. Similar in concept to 3D printing, SLM uses micron-sized metal powders for the feedstock instead of plastic. The SLM machines take metal powder from a reservoir and spread it out onto a stage, and a high-power laser melts the powder following the pattern instructed from the Computer Aided Design (CAD) software. Extremely thin layers are added repeatedly until the 3D part is completed. This new technology makes it much easier and faster to design and manufacture metal components with complex geometrical shapes.

Currently, a critical component of SLM is making and/or developing a source of uniform feedstock powders for the different alloys of metal. To help solve this accessibility problem, Dr. Shengmin Guo, a professor in Louisiana State University's College of Engineering, has developed a program that challenges the young, creative minds of mechanical engineering students to develop a powder making system as part of a senior Capstone Design project.

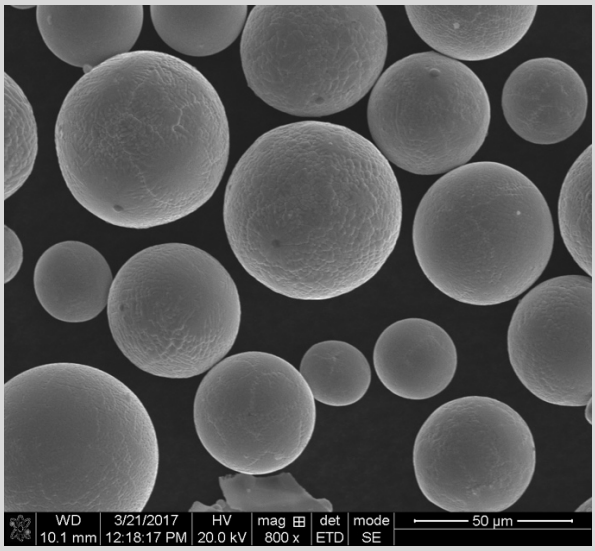
The Capstone Design involves two consecutive courses and emphasizes both the design process and the delivery of a successful engineered physical outcome. The students designed a powder-making system that is currently under testing. It features a 28,000 rpm rotating electrode atomization system. Stainless steel, titanium, and copper powders have been successfully fabricated.

In their journey through this two-semester course program, the students successfully addressed the conceptual and technical issues of design along with the challenges of hands-on manufacturing and testing.

Building upon the success of the project, a second phase has been added to the program. This summer, the speed of the rotating electrode will be increased to 90,000 rpm.

The students are mentored by Dr. Guo and other researchers with the Louisiana Consortium for Innovation in Manufacturing and Materials (CIMM). Providing students with a holistic, creative, multidisciplinary design experience in an educational setting helps to advance the design of SLM technology, and provides a personal connection toward careers in research and the advanced manufacturing industry.

Louisiana State University Mechanical Engineering students designed a rig for making metal 3D printing powders. Aaron Alford (front) inspects the metal powder rig while Michael Guidry offers suggestions. *Credit: Dr.Shengmin Guo, Louisiana State University, sguo2@lsu.edu*



Stainless steel 316 powders made by the LSU senior design group. *Credit: Dr.Shengmin Guo, Louisiana State University, sguo2@lsu.edu*

THREE REASONS this award outcome impacts U.S./global economy, national security or scientific knowledge:
This CIMM education activity provides a comprehensive design experience for a group of senior engineering students.

This CIMM education activity demonstrates the application of fundamental engineering principles, accepted design methodologies, and appropriate engineering materials to design, build, and test a powder delivery rig, which is relevant to the advanced manufacturing industry.

Successfully producing custom powders is the first step toward producing the powders in large quantity and vital to scaling up the advanced manufacturing industry in the U.S.

NSF Directorate(s)/Division(s): OIA

State(s): Louisiana