Student Training Yields New 3D Printer for Printing High Viscosity Materials

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What is the outcome or accomplishment? (1-2 short sentences describing it and why it is transformative; 50-word maximum suggested)*

Mr. John Pojman, Jr., an undergraduate student in the LSU Department of Mechanical & Industrial Engineering, designed and manufactured a new extrusion-type 3D printer for printing materials with high viscosity such as metallic powders dispersed in a polymer matrix and hollow glass beads embedded in a polymer matrix (syntactic foam). In the test, several structures with complex geometrical shapes were printed using high viscosity syntactic foam.

What is the impact? (1-2 simple sentences describing the benefits for science, industry, society, the economy, national security, *etc.*; suggested 50-word maximum)

CIMM researchers mentor and train undergraduates in materials science as they matriculate and join the future materials and manufacturing workforce in Louisiana and beyond.

What explanation/background does the lay reader need to understand the significance of this outcome? (1-2 paragraphs that might include, for example, more on who, when, where; NSF's role; support from multiple directorates/offices; what makes this accomplishment unique; additional intellectual merits; or broader impacts such as education, outreach, or infrastructure improvement that are integral to this outcome; suggested 150-word maximum)

Additive manufacturing (AM) is one of the core components of the fourth industrial revolution, called Industry 4.0. Therefore, it is essential that the U.S. manufacturing industry is supplied with a highly trained workforce that can design, manufacture, and use 3D printers for printing various structures and devices. Under the supervision of Dr. Guoqiang Li, the undergraduate student received systematic training in terms of designing the 3D printer using SolidWorks, deciding engineering specifications through thermofluidic modeling, and fabricating the 3D printer using various hands-on tools and machinery. He was able to successfully print various structures with not-easy-to-print materials such as syntactic foam with high viscosity. Figure 1 is

the assembled 3D printer, and Figure 2 shows several syntactic foam structures printed using this printer. The training not only helps this student, but also other students who will further refine and use this printer for their research and training.

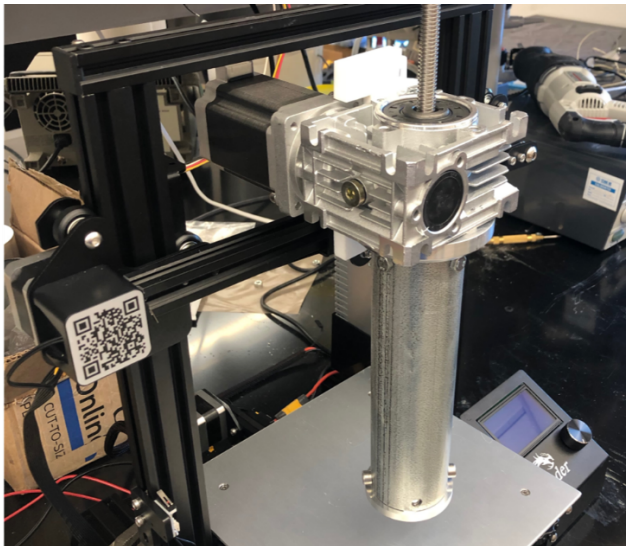

Figure 1. The fabricated 3D printer.

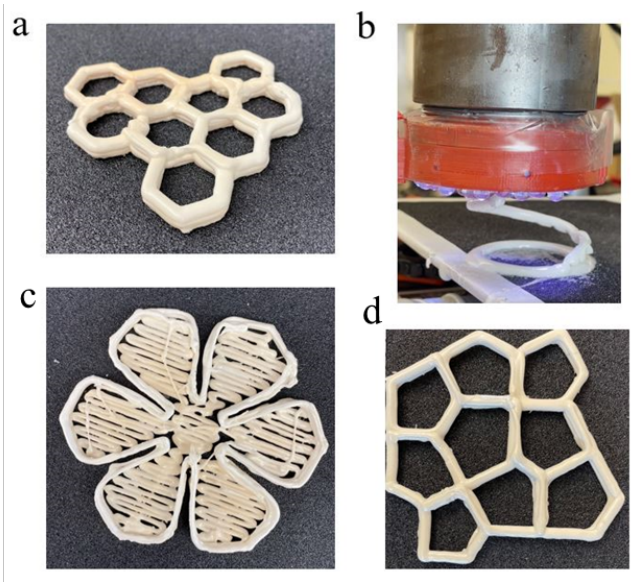

Figure 2. Several syntactic foam structures printed using the 3D printer. (a) honeycomb; (b) free-standing helical spring; (c) flower; and (d) 2D lattice.