Improving the corrosion-resistance of 3D printed metallic parts

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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)*

A group of CIMM researchers investigated the corrosion behaviors of metallic parts made by laser powder bed fusion based 3D printing and identified the methods to improve the corrosion performance of 3D printed metallic parts made out of stainless steel, titanium alloy, and copper alloy.

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

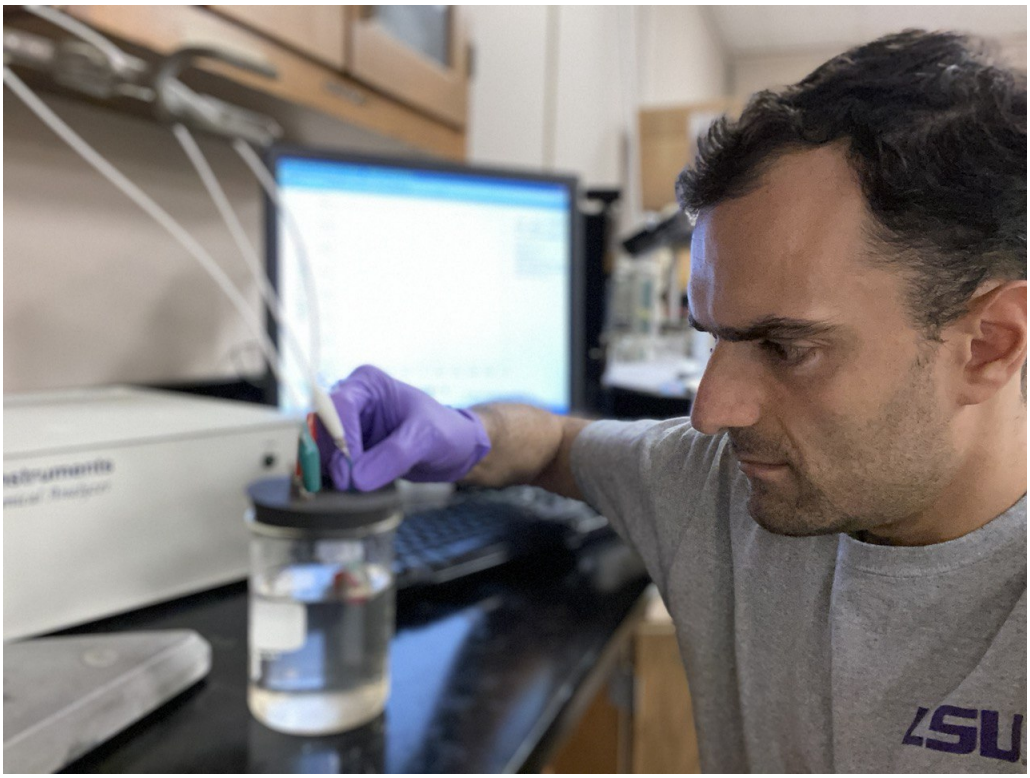
A good corrosion performance can lead to an increased life span and a reduction in the maintenance cost for industries. Knowing how to control the corrosion performance of 3D printed parts will enable the large adoption of metal 3D printing technologies.

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)

3D printing of metallic components has gained attention in recent years. To fill the knowledge gap regarding the electrochemical performance of 3D printed metallic parts, a group of researchers supported by NSF investigated the corrosion behaviors of metallic parts (stainless steel, titanium alloy, and copper alloy) made by laser powder bed fusion based 3D printing.

As-printed stainless steel 316 parts are found to have a better corrosion resistance in comparison to the parts made by other conventional fabrication methods. However, for 3D-printed titanium alloy (Ti64) and copper alloy (Cu10Sn), post heat treatment processes are required to make the corrosion performance comparable to the parts manufactured through conventional methods. Such material specific corrosion performances are found to be related to the phases formed

during the 3D printing process. Post heat treatment, if applied correctly, can modify the as-printed microstructures and relief residual stresses for improved corrosion performance.



Consortium for Innovation in Manufacturing and Materials (CIMM) researcher, Ali Hemmasian Ettefagh, examines the corrosion performance of 3D printed metallic parts at Louisiana State University. Credit: Shengmin Guo, Louisiana State University.