New 3D-Printing Processes To Speed Up Manufacturing Technology

Dr. Dentcho A. Genov

Louisiana State University

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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 team of scientists at Louisiana Tech University has developed new guidelines toward improved efficiency and rapid print rates for the next generation of 3D-printing machines based on Laser Powder Bed Fusion (LPBF). The technology improvement constitutes a transition from currently used coarse metal powders toward finer high-absorption nanosize powders.

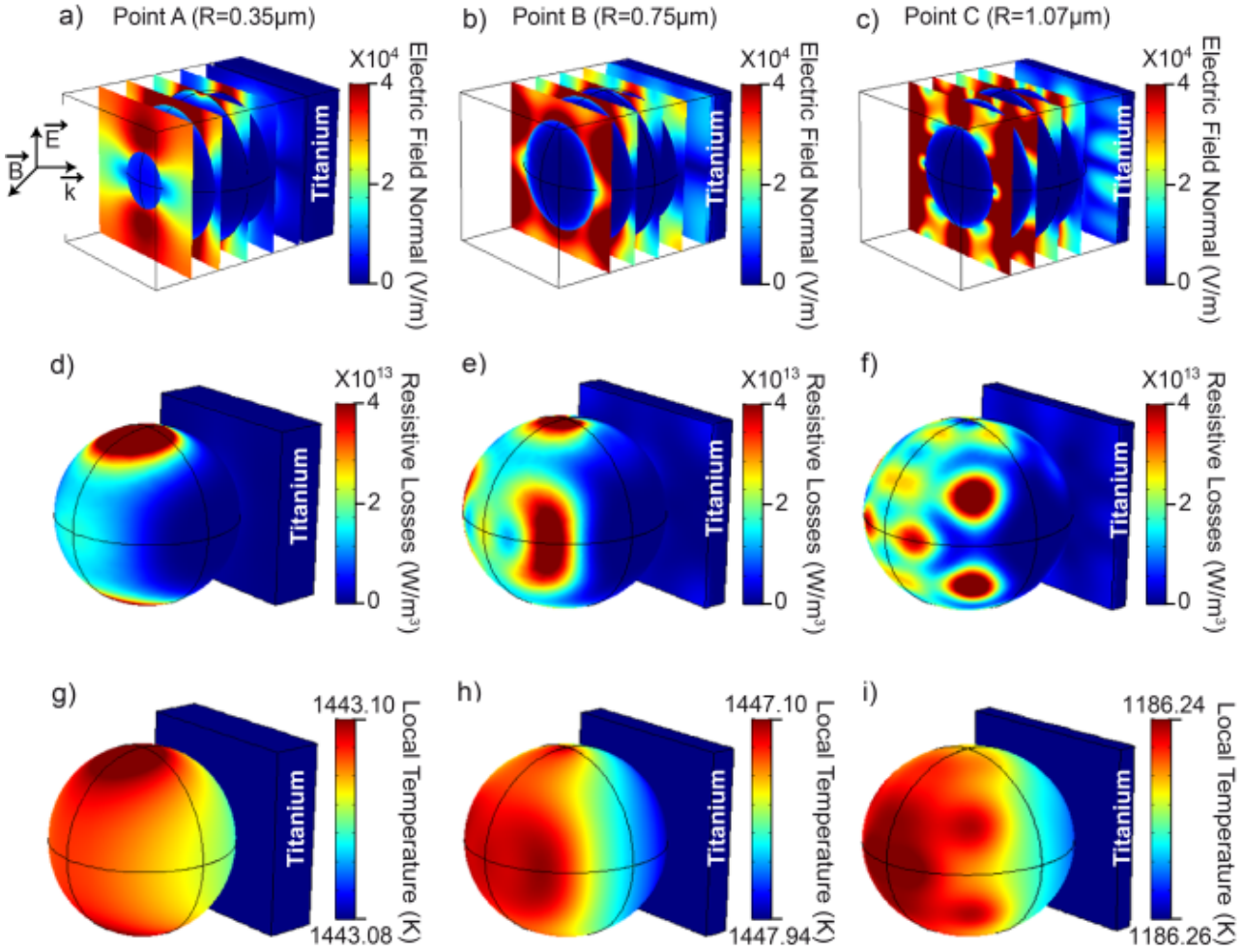
What is the impact? (1-2 simple sentences describing the benefits for science, industry, society, the economy, national security, etc.; suggested 50-word maximum)

LPBF 3D-printing is a rapid prototyping technology which provides computer generated and near geometry independent replication and/or design of new machine parts. This technology is currently used to manufacture metal parts for a vast variety of industries including aerospace, architecture, construction, dental implants, medical, art, etc. Speeding up 3D-printing processes is critical to the next generation of U.S. manufacturing.

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)

In a 3D-printing machine, a digital image of an object is first created and then used by a computer to induce a controlled laser melting and fusion of layers of a desired powdered material (metals, plastics, etc.). This layering process allows for the manufacture of objects with complex shapes. However, current 3D-printing machines are relatively slow and new solutions leading to

rapid manufacturing are needed. A team of researchers at Louisiana Tech University, working on the NSF-supported CIMM project, has developed a new way for improving efficiency to a type of 3D-printing technology called Laser Powder Bed Fusion. The team has developed a comprehensive modeling toolkit that builds all stages of the 3D-printing process, from laser radiation and absorption in the metal powders to heat transfer and melting. The research has uncovered a mechanism through which enhanced absorption can be achieved leading to significant increase in print rates.



Laser Powder Bed Fusion (LPBF) is a manufacturing process used in printing of machine parts where (a-c) laser radiation incident on metal powders is (d-f) absorbed leading to heating and (g-i) the increase of the particles temperature until melting commences. By studying these physics processes, a Louisiana Consortium for Innovation in Manufacturing and Materials (CIMM) team at Louisiana Tech University (D. Genov and R.K. Vinnakota) have proposed new industry guidelines that can result in increased speed and efficiency of the LPF printing process.