

## Floating orbs of molten metal helping scientists forge the future of the U.S. advanced manufacturing industry

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**Outcome:** A team of researchers led by Drs. Shengmin Guo and Wen Jin Meng at Louisiana State University, in collaboration with Dr. Michael Sansoucie of NASA Marshall Space Flight Center (MSFC), are measuring high-temperature thermophysical property data for liquid metals and alloys.

The data is helping the researchers understand the fundamental physics of how the molten metals and alloys behave under different conditions so they can develop metal powders and tools for laser 3D printing.

The researchers are using Electrostatic Levitation (ESL) to test the materials, which uses an electric field to levitate the molten metal and counteract the effects of gravity. Because titanium alloys are highly reactive, chemical reactions will occur between the specimen and a container, causing contaminations. Using levitation ensures the quality of the measured data without the interference of a container.

**Impacts/Benefits:** Selective laser melting (SLM) is the most widely used manufacturing system in place for making complex 3D metal parts and prototypes. This study addresses a present knowledge gap in the additive manufacturing industry, namely the lack of high quality thermophysical property data for molten metals and alloys. Understanding the thermophysical properties is crucial for optimizing SLM manufacturing processes and launching the U.S. advanced manufacturing industry toward mass production.

**Background:** SLM is the leading technique to 3D print metal and alloy parts one layer at a time. This process works by spreading a layer of metal powders, tens of microns in diameter, on a building platform, then a focused laser beam is used to melt the metal powders at selective locations.



***A levitated molten metal droplet sample.***

Credit: Dr. Shengmin Guo, Louisiana State University, [sguo2@lsu.edu](mailto:sguo2@lsu.edu).



***Louisiana State University Ph.D. student Jonathan Raush explores the Electrostatic Levitation system at NASA MSFC.*** Credit: Dr. Shengmin Guo, Louisiana State University, [sguo2@lsu.edu](mailto:sguo2@lsu.edu).