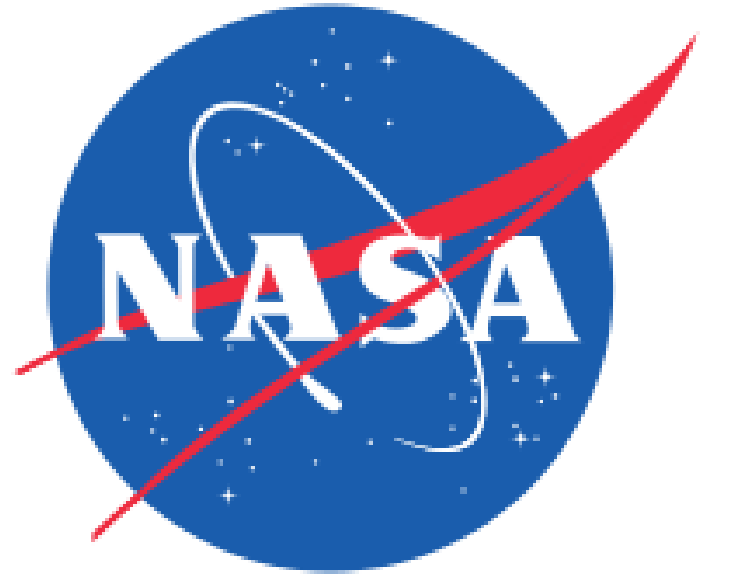# Team 14: Metal Powder Mixer and Selective Laser Melting System Integration

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Project Objectives

Mix two different metal powders to 3-D print objects with a changing layer composition using Selective Laser Melting.

Integrate the mixer with existing laser optics and control the printing process to user determined parameters.

Background

Existing powder bed systems use a single type of powder. This will be a research device to get a better understanding of the laser melting process with multiple materials, as depicted in Figure 1. The long-term goal of the research is to 3-D print functionally graded materials for aerospace applications like turbine blades.
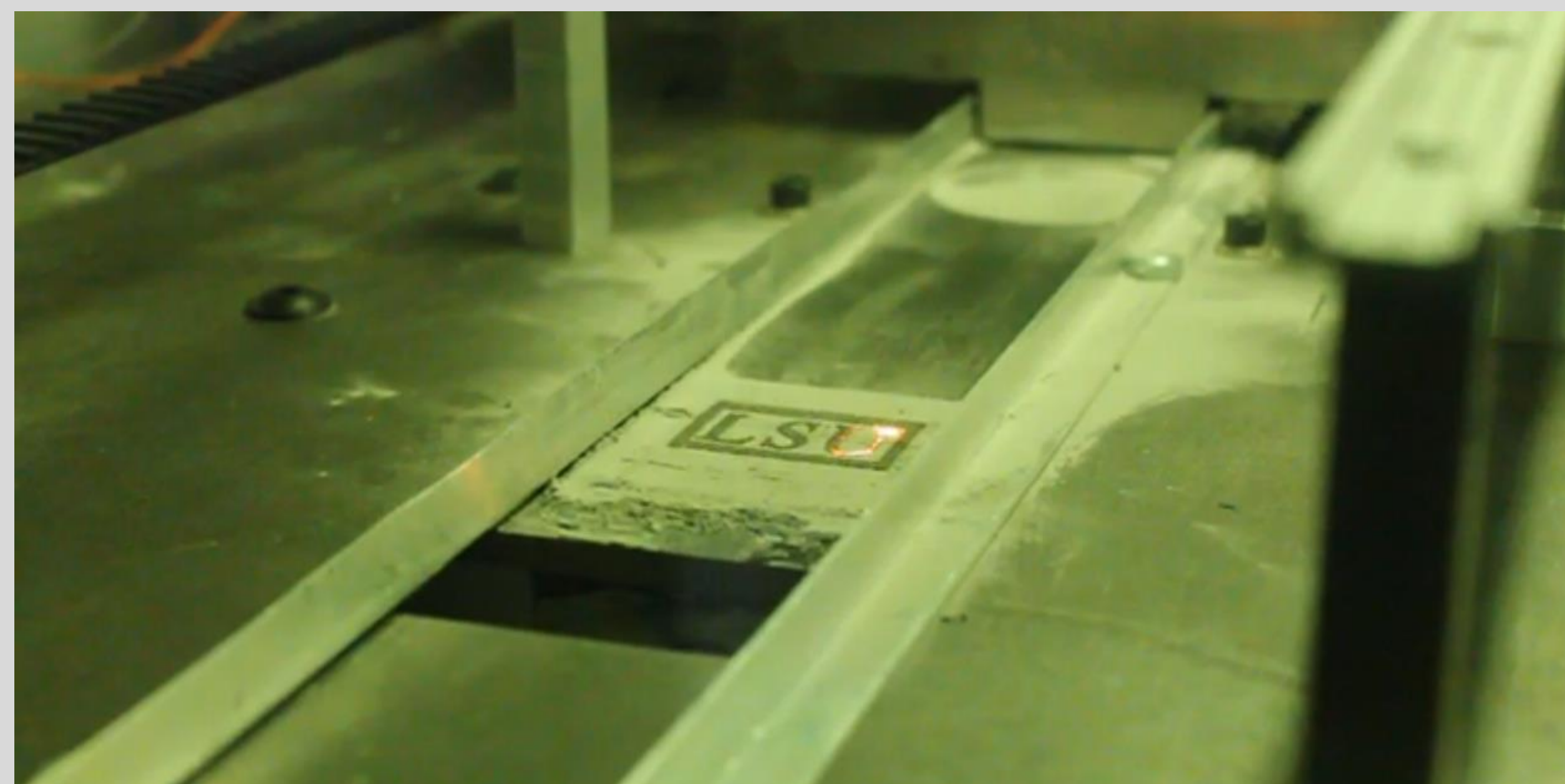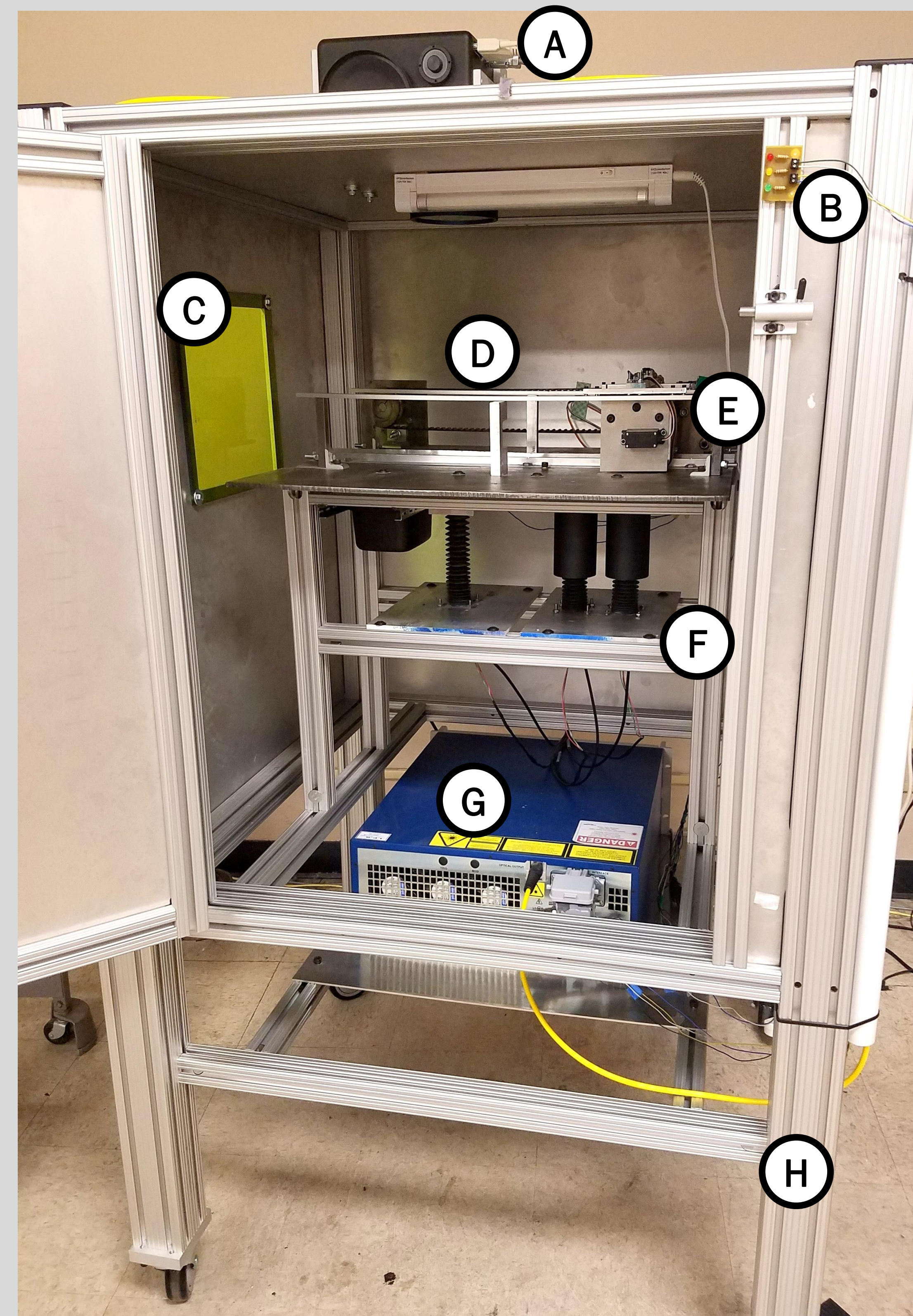
Figure 1: Laser scanner creates complex shapes in powder bed

Engineering Specifications

Build Volume:	2" x 2" x 2"
Powder Layer Height:	50 microns
Maximum Laser Power:	200 Watts
Range of Powder Size:	10 microns – 50 microns
Target Composition Accuracy:	±5%

Embodiment

A. Laser Optics

B. Interlock Indicator

C. Viewing Window

D. Rail System

E. Powder mixer

F. Stepper motors

G. Laser Generator

H. Modular Enclosure

Stage and dispenser height are controlled by stepper motors that drive lead screws. Encoders provide feedback for positioning accuracy to within 3 microns.

The mixer system's motors are controlled through programmable motor controllers. The entire process is run by scripts within the laser scanning software.

Safety

Interlocks prevent system from being energized while personnel are within the laser hazard zone.

LSU Laser Safety Office approved to be a class 1 laser system (no special PPE required in surrounding area of system).

ANSI Z136.1 Laser Safety Code compliant system.

Testing

Scanning Electron Microscopy and **Energy Dispersive Spectroscopy** show that the system achieved the desired layer composition, as shown in Figure 2.
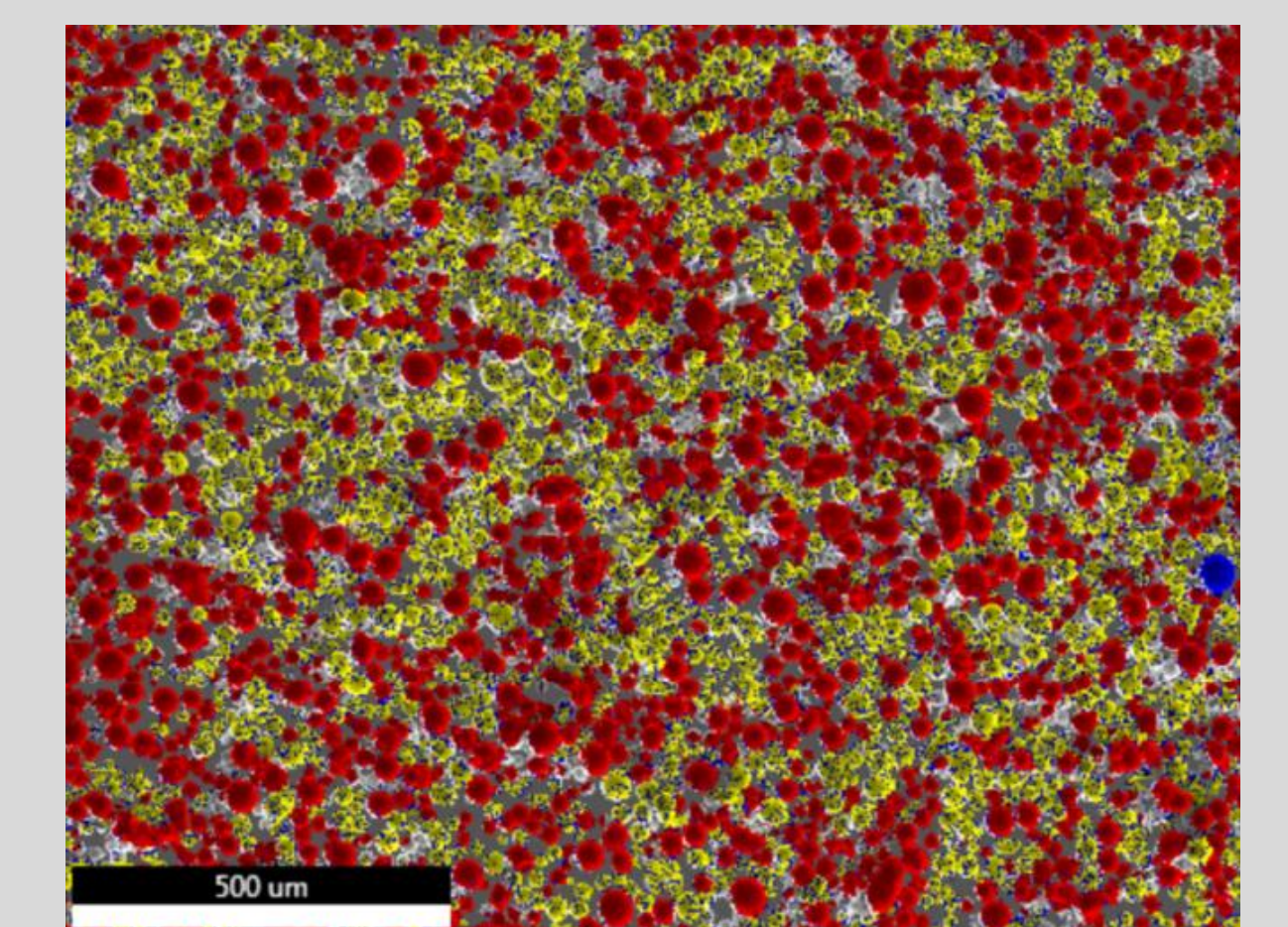
Laser melting tests were conducted for validation, depicted in Figure 1.

Figure 2: Sample with target mixing ratio of 50% vol. Haynes 230 (yellow) & 50% vol. SS 316 (red)

Project Budget

Allowed budget
$5000

Predicted Expenses
$4450

Actual Expenses
$4650

$1,449 — Consumables & Fees
$1,077 — Electronics
$910 — Dispenser & Build Area
$645 — Mixer
$234 — Enclosure
$209 — Platform

Sponsors: Dr. Shengmin Guo, LaSPACE

Adviser: Dr. Manas Gartia, LSU