

Microstructural Characterization of Additively Manufactured Metal Components

Background:

Additive manufacturing, commonly known as 3D printing, is a growing field within engineering. Additive processes can make prototyping both faster and less expensive, as well as allowing previously impossible geometry to be created for components. However, metal printing is unlike any other manufacturing method previously used, and there is still too much trial and error for many industries to take additive manufacturing seriously as a method of production. By determining and describing the characteristics of printed metals, more robust models can be developed to predict the properties of such components, ultimately giving engineers the capability of completely skipping the trial-and-error phase of additive design.

Timeline and Methods:

The proposed research will take place over a 12-week period from Monday, May 18 to Friday, August 7.

Timeframe	Task Description
May 18 – 30	I will conduct a literature search, as well as correspond with individuals presently involved with manufacturing, in order to establish a broad and relevant knowledge base.
May 31 – June 13	At this point, I will obtain and prepare specimens of printed steel and Inconel, heat treated with equivalent processes.
June 14 – 27	Once specimens are prepared, samples will be imaged via x-ray diffraction, optical microscopy, and electron microscopy.
June 28 – July 11	Images will be compiled and analyzed to identify microstructure.
July 12 – 25	Larger samples will undergo tensile testing to identify average mechanical properties.
July 26 – August 7	Final analysis will be conducted to correlate microstructure and mechanical properties, and a manuscript will be drafted for potential publication.

Outcomes:

It is my hope that my work will help in the effort to take the guesswork out of 3D printing and make such methods competitive amongst other manufacturing methods. No less important to me is the enrichment that I will get from conducting research at this university. The aforementioned manuscript will become the foundation of my Honor's Thesis, as well as give me indispensable expertise that is applicable to all levels of design and testing, making me a better engineer overall.