MATERIALS ENGINEERING

SEMINAR

"Microstructure and Defects in High-Strength Aluminum Alloys Produced by Selective Laser Melting"

By

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ABSTRACT

Since the emergence of additive manufacturing (AM) techniques in the 1980's, the application of selective laser melting (SLM) has grown a niche method of prototyping to an enabling technology for the production of high-performance structural alloys. The paradigm shift associated with additive design is of particular interest to engineering fields like aerospace and automotive engineering, where improved efficiency of design has the potential to reduce weights and improve performance. Aluminum alloys, which constitute the most used light alloy family in aerospace, are of particular interest due to their natural synergy with the goal of weight reduction. However, issues with processability have so far limited the use of precipitation-strengthened alloy compositions. Porosity and hot cracking caused by SLM lead to insufficient mechanical performance, requiring processing controls and alloying additions which minimize the cracking susceptibility of age-hardening alloys. Recent research into these methods has shown competitive mechanical properties in SLM aluminum alloys relative to their wrought counterparts. The addition of ceramic or metallic particles during SLM serves to refine and mechanically reinforce the manufactured matrix. To explore the potential and shortcomings of SLM of high-strength aluminum, characterization of microstructure, defects, and mechanical properties is discussed. Additionally, initial results from the characterization of an SLM alloys produced by reactive additive manufacturing (RAM) are presented to address routes for the improvement of high-strength alloys. Preliminary work in this area has examined AA7050-RAM2, produced by Elementum 3D, through quantitative stereography, micro- and nano-hardness testing, and correlative tomography to understand the reaction of metallic particles with the 7050 aluminum alloy in situ as a method of grain refinement.

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