Foreword

Additive Manufacturing: Interrelationships of Fabrication, Constitutive Relationships Targeting Performance, and Feedback to Process Control

Additive manufacturing (AM) offers distinct advantages over conventional manufacturing processes including the capability to both build and repair complex part shapes; to integrate and consolidate parts and thus overcome joining concerns; and to locally tailor material compositions as well as properties. A variety of fields such as aerospace, military, automotive, and biomedical are employing this manufacturing technique as a way to decrease costs, increase manufacturing agility, and explore novel geometry/functionalities. To increase acceptance of AM as a viable processing method, pathways for qualifying both the material and the process need to be developed and, perhaps, standardized.

This symposium was designed to serve as a venue for the international AM community—including government, academia, and industry—to define the fundamental interrelationships between feedstock, processing, microstructure, shape, mechanical behavior/materials properties, and function/performance. Eventually, insight into the connections between processing, microstructure, property, and performance will be achieved through experimental observations, theoretical advances, and computational modeling of physical processes. Once this insight matures, AM will be able to move from the realm of making parts to making qualified materials that are certified for use with minimal need for post-fabrication characterization.

The symposium entitled 'Additive Manufacturing: Interrelationships of Fabrication, Constitutive Relationships Targeting Performance, and Feedback to Process Control' constituted the first AM specific symposium at a TMS Annual Meeting. In the 2015 edition in Orlando, FL, USA, more than 75 talks were presented dealing with subjects ranging widely from polymer- to metal-based feedstocks as well as machine design to material performance. Speakers came from across the world including 14 countries and 4 continents allowing for a truly 'global' meeting of the minds. This new and successful meeting could not have taken place without the sponsorship of the Mechanical Behavior of Materials Committee, Powder Materials Committee, Structural Materials Division, Materials Processing & Manufacturing Division, and, finally, TMS.

The organizers of this symposium are grateful to all the participants and attendees for helping the first additive specific symposium at a TMS Annual Meeting to be successful. A special appreciation from the organizers is expressed to those individuals who leant their talents to writing the publications in the following pages. All manuscripts within this special section in Metallurgical and Materials Transactions A were subjected to the standard peer review process with a total of 8 papers eventually accepted for publication in this issue. The organizers recognize and are appreciative of the sacrifice of time made by the reviewers and the staff of Metallurgical and Materials Transactions A in helping to bring this set of papers to publication.

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