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**TMS2025**  
154<sup>th</sup> Annual Meeting & Exhibition



**March 23–27, 2025**  
MGM Grand Las Vegas  
Hotel & Casino  
Las Vegas, Nevada, USA  
#TMSAnnualMeeting



## SUBMIT AN ABSTRACT FOR THE FOLLOWING TMS2025 SYMPOSIUM:

### ADDITIVE MANUFACTURING

## Designing Complex Microstructures through Additive Manufacturing

Additive manufacturing (AM) offers unparalleled freedom to manipulate the microstructure and properties of metal alloys using complex multi-variable, multi-physics, and multi-scale processes. Fusion-based AM technology, for instance, enables fine-tuning the solidification microstructure of the metal at high spatial resolution by varying the numerous parameters which dictate melt pool dynamics. Solid-state and hybrid AM processes offer the possibility to combine mechanical treatments and joining technologies to manipulate the material's microstructure directly during production. Novel electrochemical processes open the path to precision manufacturing of components by engineering the reaction of materials precursors at the nanoscale. In addition, most of these AM processes allow direct compositional control of metal alloys by mixing and distributing the material feedstock during the process. The vastness of this processing space leads to a plethora of complex, non-equilibrium microstructures, which are unique to AM. This richness holds exciting opportunities to engineer materials properties and produce high-performance parts for frontier applications, including those in energy, aerospace & defence, and fusion. These opportunities, however, are often offset by the challenges associated with designing and predicting the optimum functionalities imparted by these complex microstructures. Moreover, our understanding of microstructure formation and evolution—both during AM as well as when parts are in service—is still limited to isolated research cases, making the derivation of universal laws difficult. This symposium aims to bring together experts in materials processing, manufacturing, and design to discuss these challenges and identify promising avenues to capitalize on the microstructure complexity brought about by AM technology.

Example topics of interest include, but are not limited to:

- Compositional and microstructural control in metal AM yielding site-specific microstructures, hierarchical microstructures, and/or heterogeneous microstructures.
- Novel AM processing strategies to achieve compositional and microstructural control of metals.
- Fundamental investigations of processing-structure-property linkages in materials with complex microstructures made by AM.
- Stability and evolution of the microstructure complexity imparted by AM.
- Computer-aided AM of materials with optimum microstructure/performance.
- Design and applications of novel materials with complex, nonconventional microstructures for frontier applications.

### ORGANIZERS

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### SYMPOSIUM SPONSORS

TMS Materials Processing & Manufacturing Division, TMS Additive Manufacturing Committee

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**QUESTIONS?**

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