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TMS 2025
154th 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

Additive Manufacturing: Length-Scale Phenomena in Mechanical Response

Additive manufacturing offers an unprecedented level of control over the local microstructure of printed parts. Processing parameters and strategies provide a huge design space for fine-tuning the microstructural features and their spatial distribution in the part to achieve optimum mechanical performance. The effective utilization of this design freedom is only possible by gaining insight into the structure-property relationships across the full-length scale. Micromechanical characterization of AM parts is an essential part of this route, helping researchers understand how the microscale mechanical behavior landscape governs the macroscale mechanical behavior. Therefore, this symposium focuses on the small-scale mechanical characterization of materials and structures produced by AM. Investigation of the micromechanical properties of various AM materials (metals, ceramics, polymers, and composites) is of interest, through experimental techniques such as nanoindentation, micropillar compression, microcantilever bending, and nanoscratch testing, as well as modeling, simulation, and data-driven studies to investigate the same. Special emphasis is on probing the mechanical behavior of interfaces, heterogeneities, and gradients, and how these features relate to macroscale properties and failure behavior.

Topics will include:

- Microstructure-mechanical property relationships of AM materials with an emphasis on micro and nanoscale behavior, and size effects.
- High-resolution property mapping through micro/nano-indentation testing, investigation of spatial variations in the builds as well as gradients in multi-material printing.
- Mechanical probing of heterogeneities, grain boundaries, interfaces, and gradient structures generated by AM techniques.
- Prediction of macroscale mechanical behavior of AM parts by small-scale testing.
- In-situ nanomechanical measurements of AM materials and structures in application environments (thermal, electrical, electrochemical, and biological stimuli).
- Small-scale fracture, fatigue, creep, and impact response of AM materials/structures and their relation to the macroscale behavior.
- Micromechanics-based modeling and simulations to interpret and predict the behavior of AM materials and structures.
- Machine learning and data-driven prediction of mechanical behavior by high throughput micromechanical testing.

ORGANIZERS

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SYMPOSIUM SPONSORS

TMS Materials Processing & Manufacturing Division, TMS Additive Manufacturing Committee, TMS Nanomechanical Materials Behavior Committee

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