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TMS2024

153rd Annual Meeting & Exhibition

MARCH 3–7, 2024
HYATT REGENCY ORLANDO
ORLANDO, FLORIDA, USA
#TMSAnnualMeeting

SUBMIT AN ABSTRACT FOR THE FOLLOWING TMS2024 SYMPOSIUM:

ADDITIVE MANUFACTURING

Additive Manufacturing: Length-Scale Phenomena in Mechanical Response

There is growing interest in using additive manufacturing (AM) across multiple industrial sectors that seek to benefit from the possibilities these emerging technologies can offer. AM offers additional degrees of freedom to "architect" the material microstructure across many length scales. Owing to this unique capability, both beam-based processes—such as powder bed fusion (PBF) and directed energy deposition (DED)—as well as non-beam-based processes—such as cold spray, additive friction stir deposition, and ultrasonic additive manufacturing—unlock new opportunities for tailoring mechanical and functional properties of metals and alloys.

The microstructures and hence, mechanical properties of AM materials can be tailored locally through careful selection of processing parameters and strategies. Therefore, the characterization of mechanical behavior across the full-length scale is key to developing novel materials and structures, particularly Understanding the macroscale mechanical behavior and properties requires gaining insight into the mechanics at the small scale. This includes the elastic-plastic response, residual stresses, creep and relaxation properties, fracture toughness, and fatigue in local scales in AM materials.

This symposium focuses on the mechanical properties of various AM materials (metals, ceramics, polymers, biological/bio-inspired materials, composites) with an emphasis on length scale effects from experimental, theoretical, modeling, and data science viewpoints.

The scope includes, but is not limited to, the following areas:

- Microstructure-mechanical property relationships of AM materials with an emphasis on micro and nanoscale behavior and size effects
- Location-specific property characterization in AM materials through micro/nano-indentation testing
- High-speed micro/nano-indentation mapping of AM materials
- Probing of heterogeneous microstructure-property relationships in AM materials/structures through small-scale testing
- Full-scale mechanical assessment of AM-built components and experimental geometries powered by micro/nano-mechanical testing.
- In-situ nanomechanical measurements in application environments (thermal, electrical, electrochemical, and biological stimuli)
- Small scale quasi-static tests (tension, compression, bending, and torsional tests)
- Small scale fracture, fatigue, creep, and impact tests of AM materials/structures
- Nano-scale measurements of strain and stress
- Micromechanics-based modeling in additive manufacturing
- Machine learning and data analysis of the micromechanical response of the AM materials/structures

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QUESTIONS?
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