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TMS 2026

155th Annual Meeting & Exhibition

March 15–19, 2026
San Diego Convention Center
and Hilton San Diego Bayfront
San Diego, California, USA
#TMSAnnualMeeting

SUBMIT AN ABSTRACT FOR THE FOLLOWING SYMPOSIUM

MECHANICS OF MATERIALS

Mechanics at the Extremes: Bridging Length-Scales From Nanoscale to Bulk

Materials under extreme conditions - such as high strain rates, cryogenic or elevated temperatures, or corrosive environments - exhibit unique and often unexpected mechanical behavior. These environments challenge the limits of material performance, requiring a deeper understanding of deformation mechanisms, failure processes, and microstructural evolution across scales. From the nanoscale, where size and interface-dominated phenomena dictate responses, to the bulk, where gradients, textures, and microstructural defects play a central role, studies of these phenomena are critical for developing materials that can withstand the most demanding environments. This symposium aims to bring together researchers exploring material behavior under single or combined extremes to highlight the interplay between experiments, theory, and simulations. Contributions addressing both fundamental mechanisms and industrially relevant mechanics challenges are particularly encouraged. By bridging insights across scales and conditions, this symposium seeks to build a comprehensive understanding of how materials respond to high strain rates, extreme temperatures, ion irradiation, and electrochemical challenges, paving the way for designing resilient, high-performance materials.

Key topics, emphasizing scale-bridging analyses throughout, include, but are not limited to:

- High strain rate behavior: probing materials from the nanoscale to the bulk under dynamic loading
- Cryogenic and high-temperature mechanical responses for applications in aerospace, deep space, and fusion energy systems
- Effects of ion irradiation on nano-to-meso-scale deformation mechanisms and failure processes to facilitate reactor material selection and performance prediction
- Environmentally assisted degradation, including hydrogen embrittlement, stress corrosion cracking, and fatigue in corrosive conditions
- Length scale bridging techniques for probing extreme conditions, such as high strain rate, high temperature, and cryogenic testing
- Computational modeling and simulation of extreme environment behavior, bridging atomic to continuum scales
- Length-scale bridging experimental and/or modeling techniques to link nanoscale mechanisms to bulk properties: understanding the influence of microstructural gradients, textures, and interfaces on performance

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QUESTIONS?

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