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MODELING MECHANICAL BEHAVIOR OF NANO- AND MICRO SCALE MATERIALS

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ABSTRACT

The extreme miniaturization in modern technology demands a deeper understanding of the unconventional, fluctuation-dominated mechanics of materials at micro- to nano-scales [1,2]. At these scales, dislocation-mediated plasticity undergoes a radical shift: sub-micron metallic samples exhibit high, but highly scattered, yield strengths. However, this behavior is compromised by intermittent strain fluctuations that undermine forming processes and threaten structural stability. As a result, a comprehensive theoretical framework that quantitatively links material characteristics to mechanical fluctuations has yet to be established. This poses significant challenges to conventional engineering models of plasticity, which were developed to describe the smooth macroscopic behavior of bulk materials, whether in isotropic, anisotropic, or crystal plasticity contexts.

This session welcomes modeling tools that address these fluctuation-dominated mechanics and provide insight into the behavior of materials at micro- to nano-scales. Contributions that offer innovative theoretical frameworks or computational approaches to better understand and predict dislocation-mediated plasticity and its effects on material performance are highly sought after.

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