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BRIDGING SIZE SCALES IN HIERARCHICAL MATERIALS: MULTISCALE MODELING AND EXPERIMENTS

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ABSTRACT

This symposium is focused on the interdisciplinary field of material modeling at different length and time scales with emphasis on hierarchical materials. The main objective is to bring together researchers and engineers from academia, industry and laboratories working on the leading edge of applied mechanics, material science and engineering, and physics to further the understanding of the mechanical behavior of materials with complex inner structure. Contributions in the area of nanostructured materials, biological and/or biologically-inspired materials, hierarchical structures, multi-scale modeling and experiments are particularly welcome.

The development of novel materials generally outpaces our understanding of structure-property relationship. Recently, significant advances have been made in the characterization, understanding and modeling of complex energy dissipation mechanisms, strengthening and toughening in high-performance hierarchical materials, but much remains to be done. The

objectives of this symposium are: a) to bridge the gap between mechanics and novel materials hierarchical microstructures; b) to present novel experiments and computational techniques that make use of advances in micro and nano-scale testing, and microfabrication; c) to assess the impact of linking length scales from atomic scale processes – modeled with interatomic potentials, and *ab initio* methods – to micro and macroscopic performance. From the computational point of view, advances in computer power have likewise facilitated the development of new methodology that examine the processes occurring at the atomic scale and predictions of the collective dynamics of ensembles of particles on a mesoscopic scale. Linking atomic scale processes – modeled with interatomic potentials, and ab initio methods – to micro and mesoscopic manifestations still remains a significant challenge.

Abstracts related, but not limited, to the following areas are welcome:

- Nanostructured materials
- Materials with several dissimilar relevant length scales. Hierarchical materials.
- Multifunctional materials, naturally-occurring and biomimetic materials.
- Structure-function relationship
- Novel modeling techniques applied to non-traditional/multifunctional materials. Composite materials with adaptive, programmable and switchable properties. Morphable and reconfigurable materials and surfaces. Energy harvesting/storage materials, etc.
- Combinations of material modeling and experimental characterization and validation for specific engineering applications.
- Effect of interfaces on mechanical properties.
- Coupled (multiphysics) problems arising from multifunctional materials.
- Materials and structures under complex thermal, environmental, diffusion, electromechanical, and other conditions.
- Modeling and prototyping methods for hypothesis testing (3D printing, imprinting, molding and embossing).