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Heterostructured Interfaces in Metal Nanolayers

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ABSTRACT:

Bimetallic nanolayered materials are advanced materials known for their exceptional mechanical strength, radiation damage tolerance, and thermal stability. In this talk, we will focus on the mechanical behavior of nanolayered metallic composites made with extraordinarily “thick” biphase interfaces. We will discuss efforts to characterize and design the morphology, size, and chemistry of the interface, especially in its third dimension (normal to the interface plane). Results from a phase field model developed to simulate the dynamic interactions of individual dislocations and these three-dimensional interfaces under applied stress will be presented. The talk will share our experimental and computational findings to date, which indicate that strength, strain delocalization, and dislocation/interface interactions are sensitive to interface thickness and through-thickness chemical gradients. We will conclude with a discussion on the intriguing possibility to design heterostructured thick interfaces to attenuate strain concentrations and postpone instabilities without sacrificing strength.

BIOGRAPHY:

Irene J. Beyerlein is a Distinguished Professor at the University of California at Santa Barbara with a joint appointment in the Mechanical Engineering and Materials Departments. She is also the Robert and Victoria Mehrabian Interdisciplinary Professor. After receiving her Ph.D. degree in Theoretical and Applied Mechanics at Cornell University in 1997, she began a postdoctoral appointment as a J.R. Oppenheimer Fellow at the Los Alamos National Laboratory, where she remained on the scientific staff in Theoretical Division until 2016. She has published one book, nine book chapters, and more than 450 peer-reviewed articles in the field of structural composites, materials processing, multiscale modeling of microstructure/property relationships, deformation mechanisms, and polycrystalline plasticity. She is an editor for Acta Materialia and Scripta Materialia. She is a member of the National Academy of Engineers and the American Academy of Arts and Sciences. Over the last decade, she has been awarded the Los Alamos National Laboratory Fellow’s Prize for Research (2012), the International Plasticity Young Researcher Award (2013), the TMS Distinguished Scientist/Engineering Award (2018), the Brimacombe Metal (2019), MRS Fellow (2021), TMS Fellow (2023), Magnesium Person of the Year (2023), and the Khan International Medal (2024).