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Deformation in amorphous-crystalline nanolaminates an effective-temperature theory and interaction between defects CHARLES K. C. LIEOU, JASON R. MAYEUR, Los Alamos National Laboratory, IRENE J. BEYERLEIN, University of California, Santa Barbara — Experiments and simulations suggest that the movement of plasticity carriers in deforming amorphous-crystalline nanolaminates is mediated by the interface between the amorphous and crystalline layers. We develop a unified theory of defects in both amorphous and crystalline materials that describes their interactions through the amorphous-crystalline interface (ACI) when nano-thick layers of the two materials are stacked upon one another. To this end, we will lay out the effective-temperature framework that describes the slow, configurational atomic rearrangements in a deforming solid driven out of equilibrium. We will show how the second law of thermodynamics constrains the defect density and the rate of configurational rearrangements, and apply this framework to dislocations in crystalline solids, as well as STZ's in amorphous materials. The effective-temperature formulation enables us to interpret the observed movement of dislocations to the ACI and the production of STZ's at the interface as a "diffusion" of configurational disorder across the material. We will conclude with some preliminary results that show agreement with experimental findings (Kim et al., Adv. Funct. Mater., 2011), and demonstrate how the ACI acts as a sink of dislocations and a source of STZ's.

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