SAND2016-4381C

ADVANCES IN MESOSCALE CRYSTAL PLASTICITY UNDER CYCLIC LOADING

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ABSTRACT. Most dislocation-based crystal plasticity approaches assume homogeneous many-body dislocation physics without considering the heterogeneities introduced by the localization of defects in mesoscale patterns. These structures promote internal stresses known as back stresses that are heterogeneous and long-range in nature and have a significant effect on the macroscopic response under monotonic and cyclic loading. This talk will present a crystal plasticity framework that explicitly incorporates length-scales and evolution laws associated with mesoscale structures such as cells and persistent slip bands in metallic materials under cyclic loading. The framework conveys a physic-based back stress formulation that depends on mesoscale structures and Eshelby inclusion formalism, which has been linked to phenomenological hardening-recovery back stress formulations. The results show agreement between models and experiments stress-strain curves for single and polycrystalline materials over a wide range of strains.

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