Active Slip Separation and the Energetics of Slip in Single Crystals

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Abstract

This research supports recent efforts to provide an energetic approach to the prediction of stress-strain relations for single crystals and to give precise formulations of experimentally observed connections between hardening of single crystals and separation of active slip bands. Non–classical, structured deformations in the form of two-level shears permit the formulation of new measures of the active slip-band separation and of the number of lattice cells traversed during slip. A formula is obtained for the Helmholtz free energy per unit volume as a function of the shear without slip, the shear due to slip, and the relative separation of active slip bands in a single crystal.