SIMULATIONS OF STRESS INDUCED GRAIN BOUNDARY MOTION

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Internal stresses and strains can have a profound impact on the evolution of microstructure, and this is the basis for nearly all thermomechanical processing techniques. Dislocation substructures, which form in many metals after plastic deformation, can lead to recrystallization, i.e. the nucleation and growth of relatively strain-free grains that consume the surrounding regions of plastically deformed material. In addition, different grains in an elastically anisotropic material can respond differently to an applied load, and thus local variations in internal stresses can promote the motion of internal interfaces in a manner that reduces the total elastic energy. We will discuss these plastic (i.e. strain) and elastic (i.e. stress) driving forces, and their implementation into a coupled simulation scheme using a sharp interface model for boundary motion and a finite element model of linear anisotropic elasticity and polycrystal plasticity for deformation. We will present results from these simulations to demonstrate the interplay between mechanical state and boundary motion, with particular focus on the associated deviations from normal grain growth.