Strong pinning of triple junction migration for robust high strain nanostructures - DTU Orbit (11/11/2019)

Strong pinning of triple junction migration for robust high strain nanostructures

The universality of a key recovery mechanism: triple junction migration in high strain nanostructures is revealed herein. This migration is the only means to uniformly coarsen deformed lamellar microstructures. Migration of medium to high angle geometrically necessary boundaries at triple junctions is resisted by strong pinning phenomena. Pinning by low angle dislocation boundaries is the novel mechanism that greatly adds to the solute drag of these higher angle boundaries during migration at triple junctions. Solute furthermore cause a significant increase in the dislocation density of the low angle boundaries formed during deformation and thus greatly enhance the observed pinning. Boundary pinning by dislocation boundaries and solute drag is analysed for deformed Ni of different purities via in and ex situ electron microscopy. A kinetic model is utilised to obtain activation energies that quantitatively demonstrate the strength of this pinning. A new strategy for achieving robust nanostructured metals is developed based on solute and dislocation pinning of triple junction migration – a universal recovery mechanism in deformed lamellar microstructures.

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