

MM 31: Invited talk Spearot

Time: Wednesday 9:30–10:00

Location: BAR 205

Invited Talk

MM 31.1 Wed 9:30 BAR 205

Importance of Dislocation Character Angle and Local Stress State Dependent Mobility Laws on Discrete Dislocation Dynamics Modeling of Plasticity in Aluminum — •DOUGLAS SPEAROT¹, KHANH DANG², DARSHAN BAMNEY¹, and LAURENT CAPOLUNGO² — ¹University of Florida, Gainesville, FL, USA — ²Los Alamos National Laboratory, Los Alamos, NM, USA

In discrete dislocation dynamics (DDD) modeling, the motion of dislocation segments is governed by mobility laws that relate segment glide velocity to the resolved shear stress in the Burgers vector direction acting on the segment. These relationships make assumptions about the role of dislocation character angle and do not consider influences of non-Schmid stresses. Thus, the objective of this work is to derive new

mobility laws for dislocations in Al using molecular dynamics (MD) simulations, which are necessary to improve the representation of the physics of dislocation motion in DDD modeling. Specifically, mobility laws for screw, 30 degree, 60 degree and edge dislocations are atomistically derived for different combinations of Escaig stress and stress normal to the (111) slip plane. MD simulations show that both phonon drag and radiative damping regimes are influenced by the presence of non-Schmid stresses, mainly through changes to the dislocation core structure. Model forms characterizing the mobility laws are incorporated into a DDD modeling tool. DDD simulations of dislocation network evolution show that the use of stress state dependent dislocation mobility laws provides changes to the plastic deformation path, leading to different final dislocation microstructures.