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Dynamics of twinning dislocations in Tantalum[1] LUIS SANDOVAL, MICHAEL SURH, ALEXANDER CHERNOV, DAVID RICHARDS, Condensed Matter and Materials, Physical and Life Science Directorate, Lawrence Livermore National Laboratory — Twinning is one of the major deformation modes of plastic deformation in crystals, being particularly important in systems under extreme conditions of low temperature or high strain rates. Despite decades of work, the nucleation and growth mechanisms of twining are still poorly understood, especially in bcc metals. Nucleation of twinning dislocations loops on the coherent twin boundary has been considered a principal mechanism of growth of deformation twins. We have used molecular dynamics simulation to study the behavior of twinning dislocations in Tantalum, in particular the dependence of dislocation velocities on shear stress and temperature. The dynamics of edge and screw twinning dislocations is isolated and analyzed. Finally we show how kinetic parameters extracted from these simulations help inform a multiscale strength model for Tantalum that includes both twinning and slip as deformation mechanisms in the regime of high strain rates.

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