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High velocity sliding at polycrystalline ductile metal interfaces[1]
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— We present the results of large scale 3-dimensional NonEquilibrium Molecular Dynamics (NEMD) simulations for Al-Al and Al-Ta interfaces for sliding velocities in the range 20-4000 m/s at pressures of 15 GPa. System sizes include 8 M, 26 M and 138 M atoms for times to 40 ns. We discuss polycrystalline samples with initial grain sizes of 13 nm and 20 nm. For velocities above a size dependent critical velocity, v_c, the frictional force per unit area agrees with single crystal simulations. For velocities below v_c, the polycrystalline interfaces evolve to a new steady state grain size distribution characterized by very large plastic deformation with larger grain sizes, time dependent coarsening and refinement, a graded size distribution in the direction normal to the sliding interface, and significantly larger frictional forces per unit area compared to similar single crystal sliding interfaces. We also find that for the Al-Ta interface the frictional properties are determined by the weaker Al material.

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