Finite Size Effects at High Speed Frictional Interfaces

J.E. HAMMERBERG, R. RAVELO, T.C. GERMANN, B.L. HOLIAN, Los Alamos National Laboratory — Non-Equilibrium Molecular Dynamics simulations have exhibited characteristic velocity weakening for the tangential frictional force at smooth single crystal interfaces for velocities greater than a critical velocity, $v_c$. This behavior has been seen in a number of material pairs including Cu-Ag, Ta-Al and Al-Al. Expressions for $v_c$ that characterize this behavior depend on system size. We discuss the size dependence for Al-Al single crystal interfaces for two cases: an Al(111)/Al(001) interface sliding along [1-10], $N=1.5 \times 10^6$, and an Al(110)[001]/Al(110)[1-10] interface sliding along [001], $N=7.5 \times 10^6$ corresponding to a three-fold increase in system size normal to the sliding direction. We find agreement with an inverse size scaling for $v_c$. We discuss the similarities in behavior for a highly defective plastically deformed sample with Al(110)[001]/Al(110)[1-10] orientation having the same normal dimension and $N=16.0 \times 10^6$.

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