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Frictional Sliding of Amorphous Contacts over Six Decades of Velocity[1] MICHAEL FALK, Johns Hopkins University, WOO KYUN KIM, University of Minnesota — Our understanding of the nanoscale origins of sliding friction primarily arises from theories of idealized crystalline surfaces in contact. However, many if not most tribological interactions involve one or more surfaces that are disordered in structure. The role that the amorphous nature of these surfaces plays in mediating friction is poorly understood. We apply an emerging simulation methodology, hyperdynamics, for the first time to friction, examining sliding between an oxidized silicon tip and surface over a previously inaccessibly wide range of sliding velocities. The simulations replicate interesting temperature dependent change in the velocity dependence of the friction force observed in this system experimentally, and reveal the nature of the intermediate state-switching transitions responsible for this behavior. A theory based on these transitions is developed and used to describe the experimental and simulated data. We conclude that this type of transition must be quite common in frictional sliding when one or more of the involved surfaces are not perfectly crystalline.

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