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Probing electronic friction in patterned silicon pn junctions JEONG Y. PARK, Lawrence Berkeley National Laboratory, D. F. OGLETREE , Lawrence Berkeley National Laboratory, P. A. THIEL, Ames Laboratory, Iowa State University, MIQUEL SALMERON, Lawrence Berkeley National Laboratory — Phononic and electronic excitations are two of the fundamental processes that give rise to friction forces between sliding bodies in close proximity. We demonstrate that electronic contributions in friction can be quite significant, and even tunable for semiconducting samples, where the free carrier density in the vicinity of the contact can be modified electronically. In our experiments one of the solids is a Si(100) sample patterned with p and n regions that provide large differences in the density of charge carriers. The pattern consists of an array of 2 μm wide strips of highly doped p-type material in a nearly intrinsic n-type substrate. The other solid is a conductive Atomic Force Microscope tip. By varying the bias between tip and Si sample, charge depletion or strong accumulation could be induced in the n and p regions, which produces significant differences in the friction force. We attribute the increase in friction force following charge accumulation to energy dissipation by electrons. This result demonstrates not only the importance of electronic contributions to friction, but also the capability to electronically control friction with potential applications to nanoscale devices with moving parts.

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