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Nanoscale friction anisotropy controlled by interface inhomogeneous slip and lattice defects[1] SHUNFANG LI, Zhengzhou U., U. of Tennessee, ZHENYU ZHANG, Oak Ridge Nat. Lab, U. of Tennessee, YANFEI GAO, U. of Tennessee, Oak Ridge Nat. Lab — Stick-slip behavior observed from nanoscale asperity friction experiments is often simulated by the one-degree-of-freedom Tomlinson model, which is unable to explain well the effects of lattice structure and interface defects, particularly the friction anisotropy. Using our recently developed Rice-Peierls framework, we study the relative sliding of two elastic half-spaces with a circular contact for two types of interplanar potential: i) triangular lattice potential (3-fold); ii) rectangle potential (2-fold). Our major findings are as follows: first, one can construct friction anisotropy from the interface interaction potential; second, one can modulate the friction anisotropy by controlling the sliding direction and the ratio of contact radius to lattice spacing. We identify that for both cases, when a/b is small, the frictional behavior approaches the Tomlinson limit, while, when a/b is large, the frictional behavior is governed by interface defects. The latter case and its resulting friction anisotropy are very sensitive to the degree of interface incommensurability.

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