Shaking Reduces Friction

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Lateral vibrations can control friction at the nanoscale, researchers reported in the 1 July 2005 issue of *Physical Review Letters*.

The researchers modeled a tip interacting with a substrate that vibrates in the lateral direction, and showed that vibrations at the correct frequency and amplitude can dramatically reduce friction, and can even make it possible to transform stick-slip motion to smooth sliding.

Previous studies have suggested controlling friction with normal vibrations; this paper adds another new method scientists can potentially use to reduce friction. The authors also suggest experiments to test the effects they predict.

Being able to control friction in this way may be useful for micromechanical devices and computer disk drives, where friction may cause unwanted stick-slip motion or damage to the device.

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Abstract

Tuning Diffusion and Friction in Microscopic Contacts By Mechanical Excitations

We demonstrate that lateral vibrations of a substrate can dramatically increase surface diffusivity and mobility and reduce friction at the nanoscale. Dilatancy is shown to play an essential role in the dynamics of a nanometer-size tip which interacts with a vibrating surface. We find an abrupt dilatancy transition from the state with a small tip-surface separation to the state with a large separation as the vibration frequency increases. Atomic force microscopy experiments are suggested which can test the predicted effects.