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Lack of Pinning for Rigid Sliding Monolayers in Microbalance[1]
ITZHAK WEBMAN[2], Bar-Ilan University, JEFFREY SOKOLOFF, Northeastern University — Recent work on the dynamics of monolayers on a metallic substrate attached to a quartz oscillator has provided interesting data on kinetic friction at the microscopic level. Sliding of the film relative to the substrate is often observed even though theoretical estimates seem to predict that the extremely small inertial forces should not be sufficient to make the film slide. It is shown here that if the defect potentials have a range of a little more than an atomic spacing, the net forces on the film due to the defects are likely to be quite small due to cancellations of the forces exerted by the defect on the atoms in the range of its potential. Thus, the net pinning force on the film is much smaller than it would be if each defect only acted on one atom at a time. It will be shown that this reduction of the pinning force due to the defects is quite significant and is able to account for the fact that films adsorbed on the quartz crystal are able to slide, even under the weak inertial forces provided by the quartz crystal's oscillations.

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