Direct Measurement of the Elastohydrodynamic Lift Force at the Nanoscale

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Abstract

we report on the first direct measurement of the elastohydrodynamic lift force acting on a sphere moving within a viscous liquid, near and along a soft substrate under nanometric confinement. Using atomic force microscopy, the lift force is probed as a function of the gap size, for various driving velocities, viscosities, and stiffnesses. The results are in excellent agreement with scaling arguments and a novel quantitative model developed from the soft lubrication theory, in linear elasticity, and for small compliances. For larger compliances, or equivalently for smaller confinement length scales, a saturation of the lift force is observed and its empirical scaling law is discussed.

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