Confined Fluids: the Time Variable in the Force-Distance Profile
JANET WONG, SUNG-CHUL BAE, STEVE GRANICK, Department of Materials Science and Engineering, University of Illinois at Urbana-Champaign — Hitherto-overlooked time dependence is known to play a prominent role in determining the friction of confined fluids. In this study, for the first time we introduce the time variable into measuring force-distance profiles of several simple alkane fluids. The existence of near-surface layered structures in confined fluids is generally manifested as oscillatory forces in force-distance profiles obtained using surface forces apparatus (SFA) and atomic force microscopy (AFM) experiments. While it is generally agreed that the rate of the experiment should be slow enough to achieve a quasi-static state, it is less clear what the appropriate rate should be. In this study, while maintaining the experimental time scale uniformly slow enough to avoid trivial hydrodynamically-induced surface deformations, we demonstrate time dependence in the measured force-distance profile. The role of time scale on the actual structure of the confined fluid will be discussed.

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