Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

Interaction model between a liquid film and a spherical probe RENE LEDESMA ALONSO, DOMINIQUE LEGENDRE, PHILIPPE TORDJEMAN, Institut de Mécanique des Fluides de Toulouse (IMFT) — To find a liquid surface profile, when performing AFM measurements, probe interaction effects should be identified. Herein, the behavior of a liquid film free surface (thickness E, surface tension γ and density difference $\Delta\rho$), disposed over a flat surface and in the presence of a spherical probe (radius R) is forecast. A bump-like surface shape is observed, due to the probe/film interaction (characterized by the Hamaker constant H_{pl}). In addition, the attraction between the film and the substrate (depicted by H_{sl}) opposes the axial and radial deformation ranges. Several parameters portray the equilibrium shape: Bond $B_o = (\Delta\rho g R^2)/\gamma$ and modified Hamaker $H_a = 4H_{pl}/(3\pi\gamma R^2)$ numbers, Hamaker ratio $A = H_{ls}/H_{pl}$, separation distance D/R and film thickness E/R. We focus on the effect of geometry, nevertheless special attention is given to the role of physical parameters. Employing an augmented Young-Laplace equation, the equilibrium profile is described by a strongly non-linear ODE. A critical distance, below which the irreversible wetting process of the spherical probe occurs, is predicted. Our results provide simple relationships between parameters, which determine the optimal scanning conditions over liquid films.

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Date submitted: 24 Jul 2012 Electronic form version 1.4