Invited presentation

Gradient dynamics description for films of mixtures and suspensions - model development and application to dewetting and line deposition

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First, we review deposition patterns created at receding contact lines and other situations where wetting, evaporation and phase transition dynamics may couple for films of complex fluids. After reviewing selected results obtained with hydrodynamic models (derived via long-wave approximation) [1,2] we reformulate these models as gradient dynamics models of nonequilibrium thermodynamics. The employed free energy functional accounts for wettability and capillarity. This form allows for extensions towards solute-dependent wettability, and solute-solvent decomposition [3]. As an example we illustrate that a film of a mixture may become unstable through the coupling of film height and concentration fluctuations and discuss resulting nonlinear dynamic behaviour and equilibrium states [4].

The next part shows that such a gradient dynamics form can also be found for films covered by insoluble [5] or soluble surfactant. Such models may be employed to describe the formation of line patterns during the Langmuir-Blodgett transfer of a surfactant layer from a bath onto a moving plate [6]. Finally, we sketch how the line deposition is equivalent to an intricate bifurcation structure thatone can analyse within a reduced Cahn-Hilliard-type model [7] and indicate how the related complex behaviour emerges through various local and global bifurcations [8].

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