

Dynamics of 3D Thin Films: from hydrophilic to super-hydrophobic substrates

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Contact line dynamics are essential to many interesting dynamic wetting problems^{1,2}, that range from the surprising climbing of partially wetting drops in inclined vibrating substrates³ to linear or spin coating of surfaces^{4,5}, mono-disperse drop formation⁶ and in-drop mixing in micro-channels^{7,8}. An exciting and relatively unexplored field is that of fluid flow in super-hydrophobic substrates, where the equilibrium contact angle exceeds 120°.

Here we study the motion of three-dimensional thin films spreading in dry inclined substrates under the action of gravity. Using lattice-Boltzmann simulations, we study the stability of the free surface in different substrates, depending on their wettability. Wetting properties in our simulations are introduced via a surface free energy, which allows us to consider substrates that range from hydrophilic to super-hydrophobic. We find that the stability of the free surface is strongly affected by the substrate wettability.

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