Hysteresis of contact angle on deformable substrates: Influence of Disjoining Pressure

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Abstract: A theory of contact angle hysteresis of liquid droplets on deformable substrates was recently developed in terms of disjoining pressure isotherm Π(h), accounting for the action of surface forces near the three-phase contact line [1]. The excess free energy calculation for a droplet deposited on a soft substrate leads to two equations for droplet and deformed substrate profiles in terms of the disjoining pressure isotherm. Advancing and receding contact angles on smooth and homogeneous deformable substrates are theoretically investigated now [2]. Disjoining pressure action is ones more considered near the three-phase contact line and elasticity of the substrate is assumed to obey Winkler's model. A simplified s-shaped disjoining pressure isotherm is adopted, allowing direct calculations of static advancing and receding contact angles. It is shown [2] that advancing and receding contact angle of a droplet on smooth, homogeneous deformable substrate depend on i) droplet volume, and ii) elasticity of the substrate (Fig.1). For deformable substrate calculated advancing and receding contact angles are lower than those on solid substrate. The results of the derived model on hysteresis of contact angle on deformable substrates qualitatively agree with known experimental observations. The obtained results agree with the contact angle hysteresis theory developed earlier for non-deformable substrates [3].

Key words: Contact angle hysteresis, Deformable substrate, Advancing contact angle, Receding contact angle

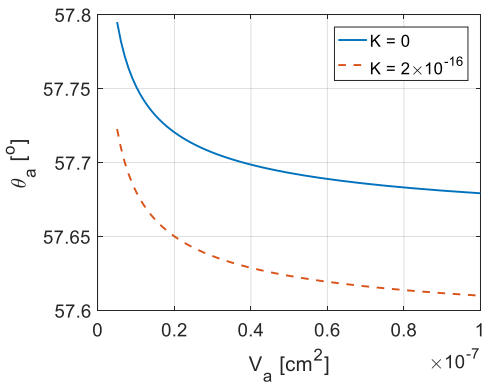

Fig. 1. Static advancing of droplets on deformable substrates are lower to those on a non-deformable substrate

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