ADAPTIVE WETTING

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The dynamic process of liquids that wet or dewet surface is not only ubiquitous in everyday life. It is also of key importance in many technological applications. Existing work mostly focuses on the influence of the topography and composition of rigid and inert substrates. Here, we discuss the wetting of adaptive surface. Adaptive substrates change their physico-chemical properties due to the presence of a liquid or its vapor. As it turns out, not only specifically designed substrates adapt, but adaptation to the liquid is a rather general phenomenon. Adaptation can explain contact angle hysteresis.

We propose a first order kinetic model to describe dynamic contact angles of such adaptive surfaces. The model is general and does not refer to a particular adaptation process. The aim of the proposed model is to provide a quantitative description of adaptive wetting and to link changes in contact angles to microscopic adaptation processes. By introducing exponentially relaxing interfacial energies and applying Young's equation locally, we predict a change of advancing □a and receding contact angles □r depending on the velocity of the contact line. Even for perfectly homogeneous and smooth surfaces, a dynamic contact angle hysteresis is obtained. As possible adaptations we discuss changes in the surface state reconstruction of polymers or monolayers, diffusion and swelling, adsorption of surfactants, reorientation of liquid molecules or the formation of an electric double-layer.