50 YEARS IN SEARCH OF THE DYNAMIC CONTACT ANGLE

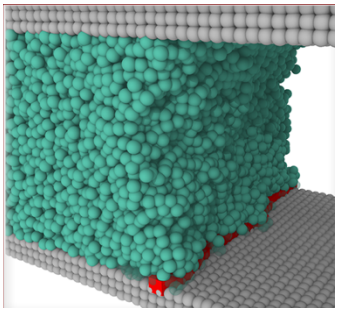
T. D. Blake

[1] Laboratory of Surface & Interfacial Physics, University of Mons, 7000 Mons, Belgium

terrydblake@btinternet.com

After introducing some essential basics and a little of the history, the presentation will focus on the molecular-kinetic theory of dynamic wetting (the MKT), first published in 1969 [1,2], and some of the increasing evidence of its relevance to our understanding of how contact lines move across solid surfaces. Much of this evidence will be drawn from molecular dynamics (MD) studies that uniquely illuminate dynamic wetting at the nanoscale.

The MD studies, which have spanned a collaboration of 25 years with Professor Joel De Coninck and his group at the University of Mons, Belgium, have replicated the many of the predictions of the MKT. They have involved simulations of spreading drops, capillary rise, the wetting of fibres, coating and Couette flow with free boundaries, plus investigations of slip and Young's equation. While keeping the properties of the liquid constant, the equilibrium contact angle has been varied from nearly complete wetting to angles similar to those seen in superhydrophobic systems. In each case, the resulting data have agreed with the predictions of the MKT and confirmed expectations such as the dual roles of viscosity and solid–liquid interaction in moderating wetting dynamics, as well as the potential of a localized shear stress to promote it during forced wetting. However, one aspect, the non-linearity predicted by the MKT (and seen in experiments) at high driving forces has yet to be realised in the simulations.



In our most recent work [3], we have investigated the spatial fluctuations of the contact line and the consequent fluctuations in the surface-tension force at the solid-liquid boundary. We have shown that one may use well-established statistical thermodynamics, (the Langevin equation) to predict the *dynamics* of wetting via the MKT by analysing these fluctuations at *equilibrium*. We hope that these studies will open the door to new experimental approaches to discover the private and still hidden life of the dynamic contact angle and the moving contact line.

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3. Fernandez-Toledano, J-C. Blake T.D. De Coninck J. 'Contact-line fluctuations and dynamic wetting' *J. Colloid Interface Sci*. **2019**, *540*, 322–329.