# Contact line dynamics on a pseudo-brush

Romain Lhermerout[1], Hugo Perrin[2], Etienne Rolley[1], Bruno Andreotti[2] and Kristina Davitt[1]

[1] *Laboratoire de Physique Statistique de l'ENS, 24 rue Lhomond 75005 Paris, France*

[2] *Laboratoire de Physique et Mecanique des Milieux Heterogenes de l'ESPCI, 10 rue Vauquelin 75005 Paris, France*

*Corresponding author: kristina.davitt@lps.ens.fr*

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Polymer brushes are nanometric layers of polymer that are attached to a solid surface. Although friction and slippage experiments have shown that they can significantly modify the mechanical properties of the underlying surface [1, 2], the impact of brushes on wetting dynamics has not yet been investigated.

We report measurements using simple liquids and so-called pseudo-brushes composed of polydimethylsiloxane (PDMS) adsorbed on silicon (see inset in Fig. 1). We show and quantitatively explain how such a nanometric layer of polymer can play a dominant role in the contact angle dynamics.

We find that both the PDMS chain length ($N$) and the nature of the partially-wetting liquid have an enormous impact on the hysteresis and on the high-velocity dynamics. Figure 1 illustrates the phenomenon. Here a series of 3 pseudo-brushes are tested with the same liquid. In one case (red curve), we find an extremely low hysteresis (< 0.1°), which is suggestive of a “perfect surface”. At the velocities shown, one usually expects that the contact line motion is dominated by hydrodynamics, and for comparison, the dashed line shows the slope from the Cox-Voïnov law. Instead we observed that the slope increases with the chain length, reaching 20 times that. With liquids that are poor solvents of the polymer, this effect is even more pronounced.

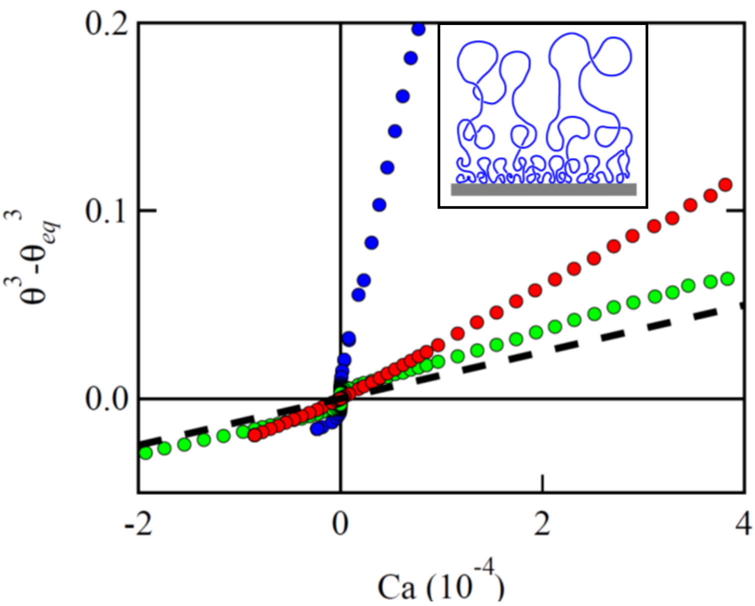


*Fig. 1: Dynamics of decane on pseudo-brushes with different chain lengths: N=9 (green); N=126 (red); N=1571 (blue). Dashed line gives the Cox-Voïnov prediction with a slope of* 9 ln($L_{macro}/l_{micro}$) ~ 9 ln(1 mm/1 nm). *Inset: Schematic of a pseudo-brush adsorbed on a silicon wafer.*

We show that this behaviour is due to an additional source of dissipation located *at* the contact line that can be isolated from the total dissipation [3,4]. We propose that despite the thinness of the polymer layer, this originates from a viscoelastic deformation of the pseudo-brush under the contact line.

## References

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