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Flow dynamics of thin polymer films: Influence of the solid/liquid interface[1]

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Nanoscale liquid polymer films are ideal candidates to probe the solid/liquid boundary condition: Prepared on a nonwettable surface like a hydrophobic Si wafer, the films are not stable, they dewet and bead off the substrate. That way, a flow is induced without applying an external force. Probing the dynamics of the dewetting process and the morphology of the liquid front, we can deduce the slip length, which is a characteristic for the solid/liquid boundary condition. A variation of the type of hydrophobic layer as top coating enables us to tune the boundary condition from a no-slip to a nearly full-slip condition. Changing the molecular weight of the polymer reveals that slippage is directly linked to chain entanglements. We find a reduced entanglement density at the solid/liquid interface (factor 3 to 4), which stresses the importance of considering non-bulk polymer properties in the vicinity of an interface.[2]

[1]Priority Program "Nano- and Microfluidics" SPP 1164 of the German Science Foundation DFG.
[2]O. Bäumchen, R. Fetzer and K. Jacobs, PRL 103, 247801 (2009)