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Dynamic Wetting of a Droplet on a Hydrophobic Micro-patterned Surface XIAN WEI, HUAN LI, CHENG WANG, XIN TANG, SASCHA HILGENFELDT, K. JIMMY HSIA, Mechanical Science and Engineering, University of Illinois at Urbana-Champaign — The dynamics of droplets moving over patterned surfaces of micro-pillar arrays is of great practical interest, but has lacked detailed study at the level of the micron-scale pattern. We develop an imaging method and a force measurement setup to study contact line (CL) evolution and contact angle hysteresis (CAH) induced resistant force for a water droplet sliding on PDMS micro-pillar arrays. The topography of the CL between droplet and surface is imaged using fluorescence microscopy in combination with high-speed video. To measure the CAH induced resistant force, a micro-force sensor is attached to the droplet and the substrate moved relative to the droplet with prescribed velocity. The resultant force-time curve displays an initial maximum and subsequently a dynamic steady state with a sawtooth-like shape. The ratio between the average force at maximum and that in the dynamic balance state is approximately constant and close to the ratio between pillar numbers at the trailing edge at both states. In steady state, the shape of the force curve can be correlated with events of pillar pinning and depinning at the CL to obtain a detailed understanding of attachment and detachment forces.

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