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Universal scales of droplet spreading on wettability-patterned wedge tracks UDDALOK SEN, SOUVICK CHATTERJEE, Department of Mechanical and Industrial Engineering, University of Illinois at Chicago, RANJAN GANGULY, Department of Power Engineering, Jadavpur University, CONSTANTINE MEGARIDIS, Department of Mechanical and Industrial Engineering, University of Illinois at Chicago — Spontaneous transport of liquid droplets on open-surface microfluidic platforms is important for a wide range of applications, and can be facilitated by having a difference of wettability on different spatial domains of the substrate. Recent studies have shown that a trapezoidal or wedge-shaped superhydrophilic track on a superhydrophobic substrate can transport microvolumes of fluid from the narrower to the wider end of the track at velocities of the order of several hundreds of mm/s and without the use of a pump or any external actuation system. Application areas of such tracks include, among others, the transport of droplets of complex biofluids in point-of-care devices, which calls for the knowledge of the spreading behavior of viscous droplets on wettability-patterned surfaces. The wetting behavior of droplets of different viscosities was observed, and a universal relationship was obtained between two dimensionless variables, which accurately described the spreading characteristics of a droplet regardless of its viscosity. Three distinct droplet spreading regimes were observed - the spreading exhibiting transition initially from a Washburn-type to a Laplace-pressure driven flow, and finally to a Tanner-type regime.

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