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Constrained Energy Minimization of a Pinned Droplet on an Inclined Plate MICHIEL MUSTERD, VOLKERT VAN STEIJN, CHRIS R. KLEIJN, MICHIEL T. KREUTZER, Department of Chemical Engineering, Faculty of Applied Sciences, Delft University of Technology, Julianalaan 136, 2628 BL, Delft, the Netherlands — A long standing problem is the prediction of the maximum volume of a droplet that can hang on an inclined plate without rolling off. A key issue in this prediction is to understand the deformation of the droplet. We show that the common assumptions of a fixed droplet base or a shape at global energy minimum result in significant errors. We study droplets on a inline using locally constrained energy minimization. The initial shape of the droplet and maximum and minimum attainable contact angles hereby put constraints on the energy minimization. This results in a history dependence of the droplet behavior before roll-off, but surprisingly, a universal behaviour of the front-to-back baselength of the droplet at roll-off. This universal behavior can be predicted from equilibrium droplet shapes on a horizontal surface and understood from energy landscapes for a 2D droplet.

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