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Spreading of Impacting Droplets on Wettability-Patterned Surfaces MOHAMED ELSHARKAWY, University of Illinois at Chicago, ANTONIO RUSSO, PIETRO ASINARI, Politecnico di Torino, CONSTANTINE MEGARIDIS, University of Illinois at Chicago — Droplet collision on solid surfaces is a long-studied field that has focused mostly on droplets striking uniform-wettability surfaces. As of now, very few studies exist that analyzed droplet impact on non-uniform (spatially) wettability surfaces. More importantly, no model exists for predicting droplet impact behavior on spatially non-uniform surfaces. Using photolithograhically-produced surfaces, we study droplet impact on axially-symmetric, non-uniform wettability surfaces. We expand upon previously presented models for uniform-wettability surfaces, and predict the maximum spreading diameter of droplets impacting on symmetric patterns on varying wettability surfaces. The present model is expanded to account for n annular regions of different wettabilities, and calculate the corresponding maximum spreading diameter. In addition, within the model we explore the concept of a wettability contrast barrier that must be overcome by the impacting droplets in order to continue their spreading phase. We show under which conditions a droplet can successfully overcome this barrier, and under which conditions it cannot. The model put forth makes strong use of the previously-reported droplet impact model of Passandideh-Fard et al. It draws upon geometric assumptions, such as cylindrical shape for the expanding liquid and spherical cap for the impacting droplet. The work is fundamental in nature, but offers valuable insight that helps understand droplet impact dynamics on non-uniform wettability surfaces.

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