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Changing Emulsion Dynamics with Heterogeneous Surface Wettability PEICHUN AMY TSAI, University of Alberta, Canada, QIANG MENG, University of Science and Technology Beijing, China, YALI ZHANG, University of Twente, The Netherlands, JIANG LI, University of Science and Technology Beijing, China, ROB LAMMERTINK, University of Twente, HAOSHENG CHEN, Tsinghua University — We elucidate the effect of heterogeneous surface wettability on the morphology and dynamics of microfluidic emulsions, generated by a co-flowing device. We first design a useful methodology of modifying a micro-capillary with desired heterogeneous wettability, such as alternating hydrophilic and hydrophobic regions. Subsequently, the effects of flow rates and heterogeneous wettability on the emulsion morphology and motion in the micro-capillary are investigated. Our experimental data reveal a universal critical time scale of advective emulsions, above which the microfluidic emulsions remain intact, whereas below this time-scale emulsions become adhesive or inverse. A simple model based on a force balance can be used to explain this critical transition. These results show a control of emulsion dynamics by tuning the droplet size and the Capillary number, the ratio of viscous to surface effects, with heterogeneous surface wettability.

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