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Surface Chemistries Dramatically Influence Cassie-to-Wenzel Transitions in Doubly Reentrant Cavities[1] SANKARA NARAYANA MOORTHI ARUNACHALAM, ZAIN AHMAD, RATUL DAS, JAMILYA NAURUZBAYEVA, HIMANSHU MISHRA[2], King Abdullah University of Science and Technology — Surfaces and membranes that can robustly entrap air on immersion in liquids have proven valuable for drag reduction and desalination. Typically, the ability to entrap air is engendered by coating rough surfaces/membranes with water-repellent chemicals. Recently, it has been demonstrated that if microstructures comprising doubly reentrant cavities (DRCs), i.e., cavities that broaden below the inlets and whose walls have T-shaped cross-section, are carved on a surface, can entrap air despite the hydrophilicity of the material. Here, we studied wetting transitions in DRCs with a variety of surface chemistries and compared them with simple cylindrical cavities (SCCs). We realized arrays of DRCs and SCCs on SiO_2/Si wafers using photolithography and dry etching processes, and modified surface chemistries of silica to realize water (intrinsic) contact angles, θ_o, 0, 40, 112. We found that life-times of Cassie-states could vary from 10^{-3}-10^{7} s. The mechanisms underlying the wetting transitions including, the diffusion of the trapped air, the capillary condensation, liquid imbibition, and the release of the trapped air as a bubble will be explained.

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