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Tunable Liquid Micromirror Based on Self-Assembly of "Janus" Particles TOM KRUPENKIN, University of Wisconsin - Madison, MIKE BUCARO, PAUL KOLODNER, Bell - Labs, Alcatel - Lucent, J. ASHLEY TAYLOR, University of Wisconsin - Madison — In optofluidics, control over light propagation is primarily achieved by using the optical properties of liquid-gas and liquid-liquid interfaces. Currently, the vast majority of existing optofluidic systems are refractive optical devices. However, reflective optofluidic devices potentially have a number of important advantages over their refractive counterparts, since they are not constrained by the relatively low refractive index contrast commonly found in liquid-liquid and liquid-gas interfaces. In this work, we propose and experimentally demonstrate a novel approach that makes it possible to create tunable reflective liquid surfaces by combining the flexibility and tunability of liquid-liquid interfaces with the excellent reflective properties of solid metal surfaces. We employ self-assembly of reflective solid "Janus" particles at the interfaces between polar and non-polar liquids to create highly flexible, continuous, reflective "carpets" capable of acting as spherical micromirrors. We have successfully demonstrated electrowetting-based dynamic tuning of these micromirrors, including electrical control over mirror shape and focal distance. The mirror self-assembly process was studied as a function of the particle functionalization and of the chemical properties of the liquids involved. Potential applications of the proposed mirrors are also discussed.

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