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Using Thermo-Responsive, Fiber-filled Gels to Control Droplet Motion GERALD MCFARLIN IV, XIN YONG, OLGA KUKSENOK, ANNA BALAZS, University of Pittsburgh — Using a polymeric gel and elastic fibers, we design a thermo-responsive composite film that can be harnessed to manipulate the droplet motion in microfluidic devices. At low temperatures, the fibers are hidden and unable to interact with external fluid. At higher temperatures, the gel shrinks and exposes the fibers to the external solution; hence the exposed fibers can be utilized to hinder the motion of fluid-driven droplets on the film surface. We use dissipative particle dynamics (DPD) to model our system. We construct the gel in a coarse-grained manner by crosslinking polymer chains. We examine the volume phase transition and swelling kinetics of the gel in explicit solvents and validate our model through comparisons with Flory-Huggins theory. During simulations, a hydrophobic droplet is introduced to the outer solvent and driven over the film surface by an external flow. We focus on the effects of the imposed flow, temperature variations, and droplet-fiber interactions on the droplet's motion. We show that by varying the temperature of the system, we can program the film to interact with the droplet in a well-controlled manner. Our findings reveal how nanofibers can be used to enhance the properties of thermo-responsive gel coatings.

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