Optofluidic Applications Using Droplet Resonators and Optical Fiber Resonators Coupled with Tapered Optical Fiber Waveguides

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Sessile microdroplets of water and other polar liquids take almost spherical shapes when standing on a superhydrophobic surface. With their truncated microsphere geometry, they act as optical microcavities hosting whispering gallery modes. We achieved coupling to liquid droplet resonators kept in a controlled humidity chamber with optical fiber waveguides. In these experiments, quality factors exceeding 1 million were observed. A method for self-stabilization of the size of the droplet resonators was also demonstrated using a fixed wavelength heating laser in addition to the probe laser coupled to the same tapered optical fiber. Self-stabilization mechanism relied on the absorption resonances of the heating laser encountered by an initially condensating droplet.

I will also discuss the recent experiments we are pursuing with optical fiber resonators. In these experiments, we achieved bulk refractive index sensing with a limit of detection of around 10^{-5} refractive index unit. We are now pursuing experiments on hydrogen gas sensing and structural characterization of polymer coatings using optical fiber resonators.

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