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Ultra-high-Q Microcavities for D_2O Detection[1] ANDREA ARMANI, DENIZ ARMANI, California Institute of Technology, SEAN SPILLANE, Hewlett-Packard Laboratories, KERRY VAHALA, California Institute of Technology — Ultra high Q optical microcavities ($Q > 10^6$) provide a method for boosting detection sensitivity over conventional detection methods. In a recently published work, the difference between quality factors (Q) of microcavities immersed in D_2O and H_2O was measured and calculated. Due to the higher absorption of H_2O, resonators immersed in H_2O have lower Q's than those immersed in D_2O. This difference in absorption can be exploited to use the resonator as a D_2O detector. The effect on Q is most noticeable at 1300nm, where the Q in water is 10^6 and the Q in D_2O is 10^7. At longer wavelengths, both Q(D_2O) and Q(H_2O) are further degraded, reducing the efficacy of detection, and at shorter wavelengths, Q(D_2O) and Q(H_2O) become similar, reducing the effect that the presence of D_2O alone has on Q. By monitoring the quality factor, .01 M concentration of D_2O in water (10^{17} molecules of D_2O) has been detected; however, the actual sensitivity limit is far better than this concentration value. Detection has also been demonstrated by cyclic introduction and flushing of D_2O, leading to cyclic degradation and improvement of the Q, thereby demonstrating reversible detection.

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