

Whispering gallery mode resonators for trace gas sensing in the near/mid-infrared

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Practical trace gas sensor devices rely on resonant cavities to achieve the long path lengths necessary for highly sensitive absorption spectroscopy. One such type of resonator, the dielectric microsphere, has been studied extensively for visible light, and offers great potential in terms of this application. These resonators sustain so-called whispering gallery modes, where the field is confined to the microsphere equator region by total internal reflection. Recently, novel waveguide materials with high transmission and index of refraction in the near/mid-infrared have become available. We propose extension of microsphere resonator technology to this spectral region, where many molecules have strong absorption bands. In this pursuit, we have fabricated multiple microspheres from ZrF_4 , As_2S_3 , and As_2Se_3 optical fiber using a CO_2 laser reflow process. Experimentation is currently ongoing to couple laser radiation at $\sim 2.65 \mu m$ into the whispering gallery modes, and to measure resonator figures of merit.