Mid-infrared high-Q germanium photonic crystal cavity

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Mid-infrared (MIR) photonic crystal (PC) cavities with high quality (Q) factors are key components for various applications in nonlinear optics, lasing, biochemical sensing, and spectroscopy due to their features of long cavity photon lifetime and strong light confinement. Previously, such devices have been studied mainly on silicon integrated platforms and the development of high-Q germanium PC cavities is still in its infancy. Compared with silicon, germanium possesses a wider transparency window (2 μm - 15 μm), a higher refractive index (~4), and a higher third-order nonlinear susceptibility (~10^{-18} m^2/V^2). In this talk we report our experimental demonstration of a high-Q germanium PC cavity in the MIR spectral region based on a germanium-on-insulator wafer, as shown in Fig. 1. Moreover, we show our monolithic integration of the high-Q germanium PC cavity with a suspended-membrane waveguide and a focusing subwavelength grating. Our device pave a new avenue for the study of on-chip light interactions with germanium and the development of on-chip MIR applications in sensing and spectroscopy.

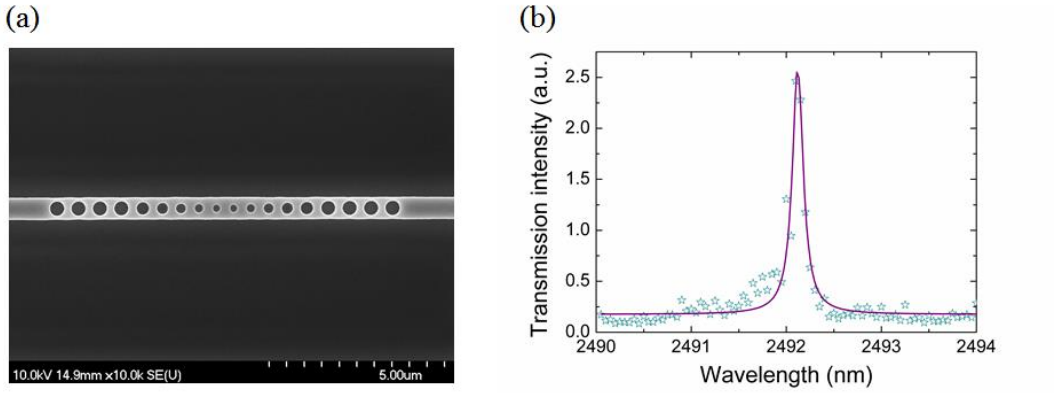

Fig. 1. Measured resonant spectrum of the high-Q PC cavity. (a) Scanning electron microscopy image of the fabricated PC cavity. (b) Resonant spectrum of the fabricated PC cavity.