Cavity-resonator-integrated guided-mode resonance filter for aperture miniaturization

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Abstract: A guided-mode resonance filter integrated in a waveguide cavity resonator constructed by two distributed Bragg reflectors is designed and fabricated for miniaturization of aperture size. Reflection efficiency of >90% and wavelength selectivity of 0.4 nm are predicted in the designed SiO_2-based filter with 50-μm aperture by a numerical calculation using the finite-difference time-domain method. A maximum reflectance of 67% with 0.5-nm bandwidth is experimentally demonstrated by the fabricated device at around 850-nm wavelength.

OCIS codes: (050.6624) Subwavelength structures; (230.7408) Wavelength filtering devices; (050.2770) Gratings; (130.3990) Micro-optical devices; (130.2790) Guided waves.

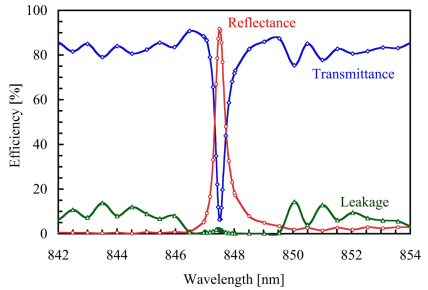

Fig. 2. Calculated reflection and transmission spectra of the designed CRIGF with 50 μm aperture.

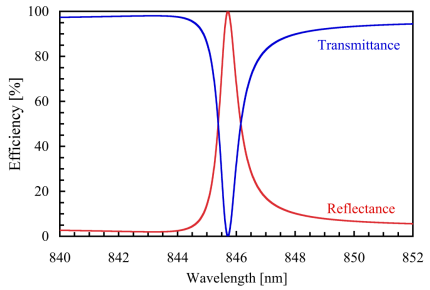

Fig. 3. Calculated wavelength dependence of the conventional GMRF with the same composition and an infinite aperture.

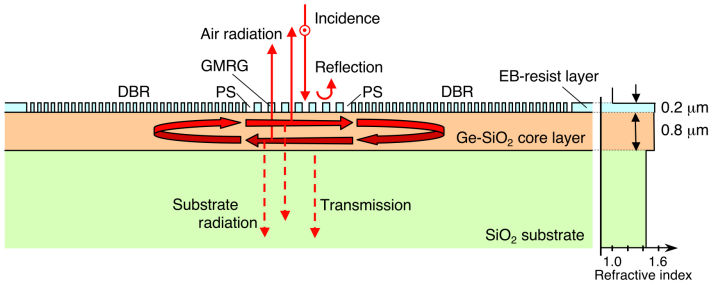

Fig. 1. Schematic cross-sectional structure and refractive index profile of the designed CRIGF.

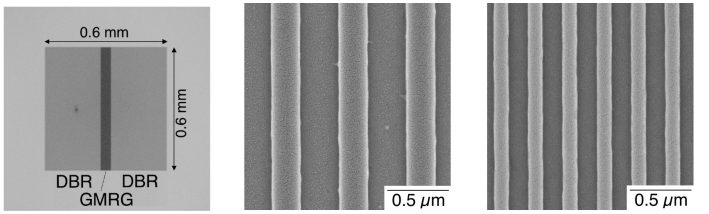

Fig. 4. (a) Microscope photograph of the fabricated CRIGF. SEM photographs of (b) GMRG and (c) DBR parts.

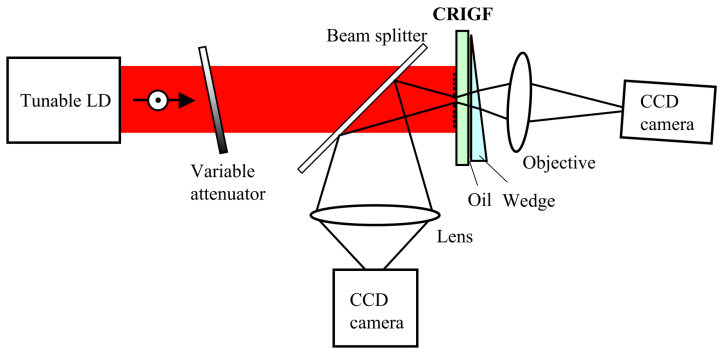

Fig. 5. Schematic view of the optical experimental setup for measurement.

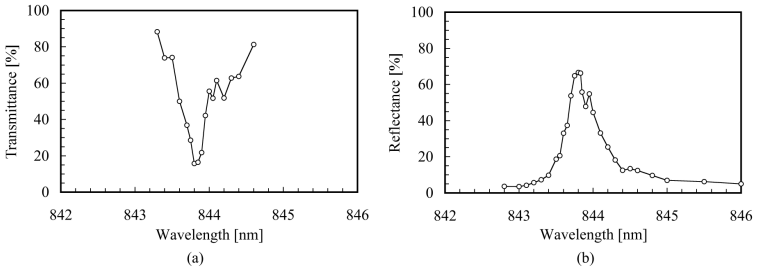

Fig. 6. Measured wavelength dependence of (a) transmission and (b) reflection for the fabricated CRIGF with 50 μm aperture.