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Abstract

The aim of this work is to experimentally investigate one-dimensional (1D) photonic crystals (PCs) and the photo-induced effect of their defect layer. A radio frequency (RF) magnetron sputtering technique was used to fabricate ten-pair 1D PCs with and without a single defect layer, utilizing TeO_{2.33} and SiO₂ with different refractive indices. The photonic band structures in the PCs were also analyzed, and the measured transmittance (T) spectra were compared with the simulated results. The 1D PC without a defect layer had a forbidden band gap in the wavelength range of 1,203–1,421 nm. The 1D PC with defect layer generated a sharp peak within a photonic band gap (PBG) at the central wavelength of 1,291 nm. After exposure to a He-Cd laser of $\lambda = 325$ nm, the resonant T peak shows red-shift because of photodarkening effect caused by the behavior of valence-alternation pairs (VAPs) in amorphous chalcogenides.

Keywords: One-dimensional photonic crystals, Photonic band gap, Photo-induced effect, Photodarkening, Sputtering, Defect layer

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