

Thermo-effects and light-illuminant effects for refractive index modulation of a photonic crystal structure

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Thermo-optical effects are inevitable when light is applied to modulate the optical devices by changing their material properties especially for those needed to be modulated by the light with rather high power [1]. We study the transmission performance of a 2D photonic band-gap (PBG) structure under different pumping power (Fig 1). It is a two-port structure with one row of rods missing to form a waveguide. The whole structure was fabricated on a silicon wafer and the PBG lattice constant is 570 nm [2]. The radii of the central resonator and the rods are 275 nm and 112 nm respectively. When the pumping light is on, the temperature and the light induced free carriers modulate the central resonator simultaneously. However, the combo-effects can be separated from thermo-effects by simply switching off the pumping light (Fig2). It is found that the performance of the optical switch depressed due to the dramatically increased thermo-effects when higher pumping power is applied (Fig3).

[1] Selin H.G. Teo and A.Q. Liu, *Applied Physics Letters*, **89**, 091910(2006).

[2] Selin H.G. Teo and A.Q. Liu, *J. Vac. Sci. Technol. B*, **22**, 2640(2004).

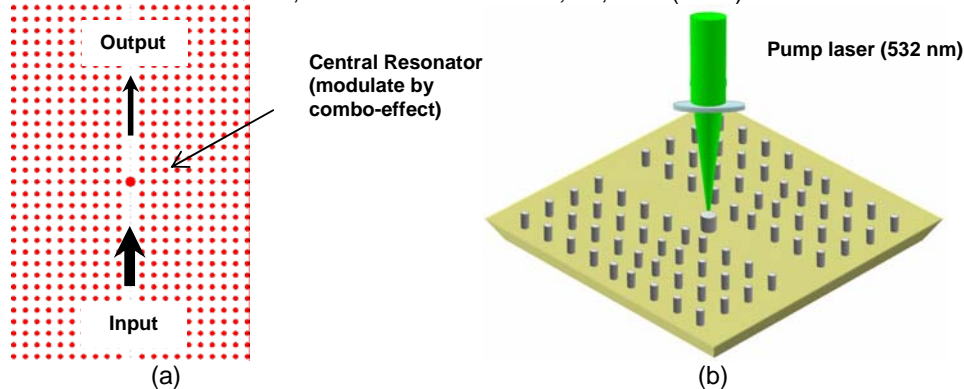


Fig 1 The schematic diagram of the PBG structure (a) and the experiment setup (b)

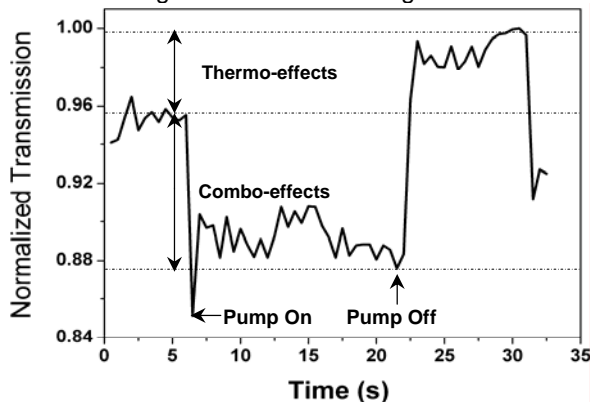


Fig 2 Time evolution of transmission of the probe light (1632.5 nm)

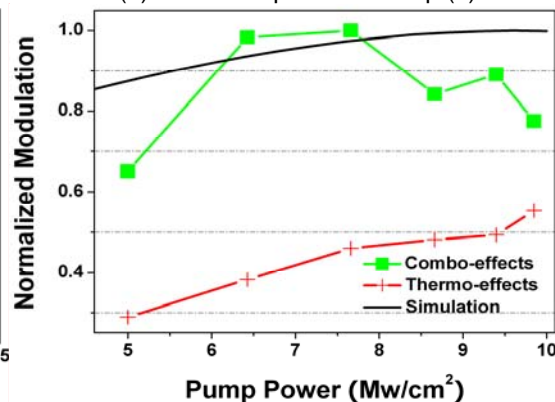


Fig 3 Simulation and experiment results of the PBG structure.