

Optical nonlinearity-induced phase shift in quantum dots-embedded photonic crystal waveguide measured by pump/probe analysis

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Optical nonlinearity (ONL) of self-assembled InAs quantum dots (QDs) embedded in a 2D photonic crystal (PC) waveguide (WG) was characterized by optical phase shift measurements. The ONL is a critical property of QDs for operating the proposed PC/QD-based all optical devices: PC-SMZ [1] and PC-FF [2]. The PC-WG was fabricated in a 250-nm-thick GaAs slab including four-layer stacked QDs grown by MBE (the inset of Fig.1). The phase shifts of a probe pulse induced by a pump pulse with ~ 300 fJ in energy are plotted in Fig.1. The phase shift depends on the group velocity (V_g) of the probe pulse in the PC-WG, reaching maximum 270° at the lowest V_g . The results indicate the slow light effect for an enhancement of the ONL enough for operating the PC-SMZ at an extremely low switching energy. [1] H.Nakamura *et al.*, *Opt. Exp.* **12**, 6606 (2004). [2] K. Asakawa *et al.*, *New J. Phys.* **8**, 208 (2006).

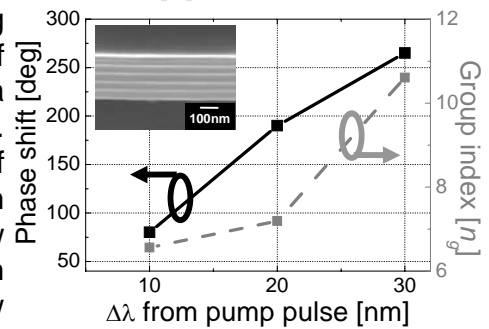


Fig.1 Phase shift (solid line) due to the ONL of QDs and n_g (dashed line) of the probe pulse vs. detuning wavelength from the pump pulse.