

## Mode identification of high-Q single-defect nanocavities in quantum dot-embedded photonic crystals

M. Shirane<sup>1</sup>, S. Kono<sup>1</sup>, J. Ushida<sup>1</sup>, N. Ikeda<sup>2,3</sup>, S. Ohkouchi<sup>1</sup>, Y. Sugimoto<sup>2,3</sup>, and A. Tomita<sup>1,4</sup>  
<sup>1</sup>NEC Corporation, Tsukuba 305-8501, Japan, <sup>2</sup>AIST, Tsukuba 305-8568, Japan  
<sup>3</sup>University of Tsukuba, Tsukuba 305-8577, Japan, <sup>4</sup>SORST-JST, Tsukuba 305-8501, Japan

We investigate the quality (Q) factor and the mode dispersion of single-defect nanocavities based on a triangular-lattice GaAs photonic-crystal (PC) membrane, which contain InAs quantum dots (QDs) as a broadband emitter. To obtain a high Q factor for the dipole mode, the radii and positions of the air holes surrounding the nanocavity are modulated while keeping six-fold symmetry [Fig. 1(b)]. A maximum Q of 17,000 is experimentally demonstrated with a mode volume of  $V = 0.39(\lambda/n)^3$ . We obtain a  $Q/V$  of  $44,000(n/\lambda)^3$ , one of the highest values ever reported with QD-embedded PC nanocavities. We also observe ten cavity modes within the first photonic bandgap for the modulated structure [Fig. 1(a)]. Their dispersion and polarization properties agree well with the numerical results.

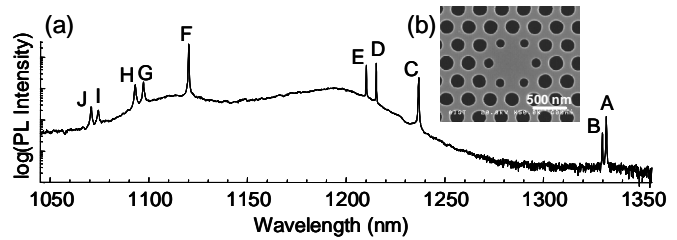


Fig. 1: (a) Cavity mode spectrum. (b) SEM image of the PC