

Fabrication and characterization of 2D photonic crystals in GaInAsP/InP semiconductor laser heterostructures

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We have designed, fabricated and tested two-dimensional (2D) photonic crystal slabs made out of III-V semiconductor materials. Short period superlattices $(\text{InGaAsP})_m/(\text{InP})_n$ have been synthesized by solid source molecular beam epitaxy (MBE). They can be arranged to make active layers (with quantum wells) suitable for light emission around 1.5 microns. The nanostructured pattern necessary for the fabrication of photonic crystals on these semiconductors is achieved by electron-beam lithography on a poly-methyl methacrylate (PMMA) layer on top of a SiO_2 layer used for mask during dry etching. Reactive ion beam etching (RIBE) is used to remove the semiconductor material inside the holes and make air-filled cylinders in the semiconductor slab. Finally, optical characterization of the photonic structures (cavity resonators) is performed by micro-photoluminescence. Modes on cavities of different sizes (H1, H3 and H5) are detected near 1.5 microns showing bandgap confinement in the fabricated structures.

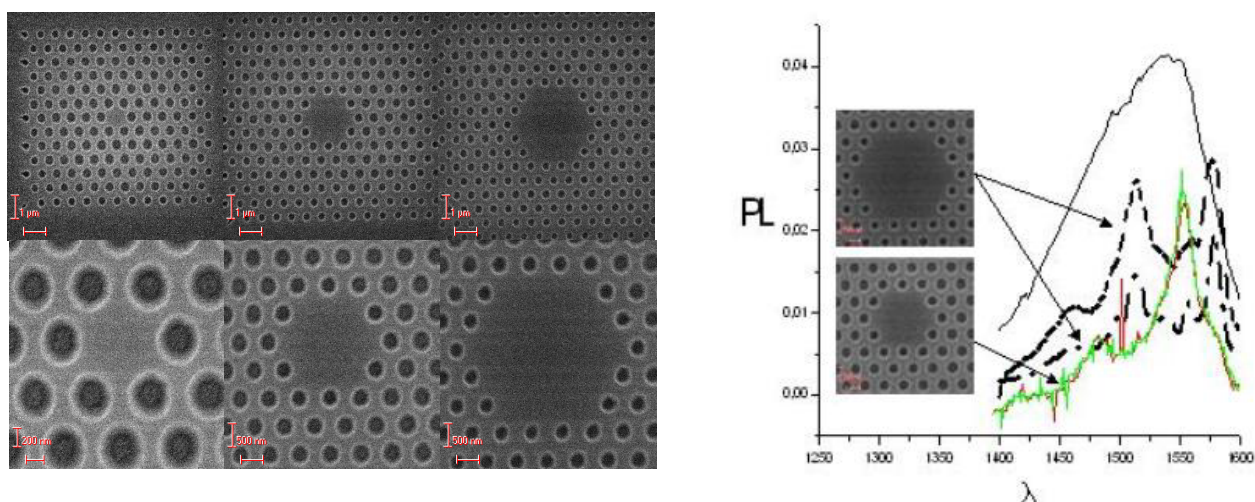


Figure.1. Left panel: SEM pictures of micro and nanocavities fabricated. Right panel: Micro-photoluminescence spectra of the unprocessed material (black continuous line) and of the cavities fabricated (H3 & H5), showing the peaks associated with the allowed modes inside the photonic bandgap region.