Photonics at nanometer scale : tracking light in high Q low V nanocavities

Philippe Velha, Benoit Cluzel, Loic Lalouat, Emmanuel Picard, David Peyrade, Jean Claude Rodier, Thomas Charvolin, Philippe Lalanne, Frédérique de Fornel and Emmanuel Hadji,

CEA/DRFMC/SiNaPS, 17 rue des martyrs, 38054 Grenoble Cedex 9, France
CNRS/IOTA, Université Paris XI, 91403 Orsay Cedex, France
CNRS/Université de Bourgogne/LPUB, 9 av. A. Savary, BP 47870, 21078 Dijon, France
CNRS/LTM, 17 rue des Martyrs, 38054 Grenoble cedex 9
contact:emmanuel.hadji@cea.fr

Photonic crystals (PCs) have proven to be an efficient way to tightly confine the electromagnetic field in nanocavities or slow down light propagation within optical waveguides. Very recently it has been proposed to use a nanometric optical probe to observe in near-field the light confinement and propagation within PC devices. In this work we analyze the optical properties of PC nanostructures by using a SNOM probe in collection mode in association with transmission measurements. We also explore the possibility to use the nanometric tip for a new class of Near-field Optics Nanometric Silicon Systems (NONSS) dedicated to on-chip information routing and processing.

In a first step, we show that with to the SNOM probe it is possible to evidence different light behaviours depending on optical mode profile. Mode coupling in PC waveguides and quality factor changes in PC nanocavities will be discussed.
Then in a second step, we show that strong field confinement enhancement can be achieved in nanocavities by proper mirror designs including mode matching and losses recycling. A quality factor (Q) enhancement by two orders of magnitude is observed. These experimental results are discussed in light of numerical calculations.
Finally, in a third step, we fabricated a nanocavity in a monomode SOI ridge waveguide with an ultimately low microcavity modal volume of $0.6(\lambda/n)^3$. We use this high-Q low-V nanocavity to explore the nanocavity - nanometric optical probe interaction.

References:

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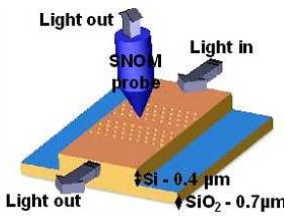
Figures:



Near-field analysis