Impact of a SNOM probe on photonic crystal optical modes

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Two-dimensional photonic crystals (PC) structures possess very attractive features for integrated microphotonics. Their ability to modify, tailor and confine electromagnetic fields at the nanoscale has led to the design of compact laser sources and optical resonators. PC-based microcavity can present a large quality factor (Q) while preserving a small modal volume (V), thus enabling the high Q/V ratio required for studying cavity quantum electrodynamics at the single source level.

To analyze the coupling between the sources and the cavity, one must observe directly and locally the field distribution inside the cavity. Because of the small size of such a cavity, far-field techniques, which are usually diffraction-limited, fail to achieve the needed resolution. In previous study we showed that near-field scanning optical microscopy (NSOM) is an efficient tool to probe the local distribution of the electromagnetic field in the PC-based microcavity on a subwavelength level [1,2]. Indeed these information yield the real field distribution as far as the coupling between the NSOM probe and the photonic crystal mode remains weak.

In the present work, comparison between 3D-FDTD simulations and experimental results on active stick microcavities will be presented to emphasize the effect of the probe material on the emission wavelength and the relative induced losses [3], and the importance of the probe shape when observing directly and locally the field distribution with SNOM.

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