Presenter

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Abstract

Title: ***Perturbations of WGMs in microcavities caused by embedded nanoparticles***

Sensitivity of high quality (*Q*) WGMs in the microcavity resonators is extensively investigated for various sensing applications. Most of the studies done in this regard consider the situation where the nanoparticles causing the perturbation are deposited at the outer sidewall surface of cylindrical or spherical cavities. It is known that slight changes in the index or size of the particles affect the resonance wavelengths and Qs of the WGMs.

In this work we consider perturbations of WGMs in cylindrical microcavites caused by nanoparticles located not only at the outer surface, but mainly inside the cavity at various distances from its surface. Such embedded nanoparticles can be realized in porous cavities as well as in semiconductor cavities containing self-assembled quantum dots. We show that the perturbation of WGMs is maximized if the nanoparticle is placed at the antinode of the radial field distribution. This situation leads to a series of phenomena such as formation of standing waves with pronounced mode splitting, mixing of the modes, and enhanced interaction with the field. To explore these, we studied perturbations of WGMs in 5 μm cylindrical cavities caused by embedded 200 nm nanocylinders with slightly different index. We performed numerical modeling of electromagnetic field distribution based on 2D FDTD simulations using FullWAVE^{TM} software. We show that the WGM resonances display double-peak structures due to scattering introduced by nanocylinders. These results can have applications in developing biochemical sensors as well as in interpretation of cavity QED experiments on strong coupling with quantum dots in semiconductor structures.

Biography

DR HIREMATH *is a postdoctoral researcher at University of North Carolina at Charlotte in Center for Optoelectronics and Optical Communications. He has a PhD in Applied Mathematics from University of Twente, the Netherlands (2005), MSc in Mathematics from Indian Institute of Technology Bombay, India (1999), and BSc (Honors) in Physics from Shivaji University, Kolhapure, India (1997). His PhD dissertation was on "Coupled Mode Theory Based Modeling and Analysis of Circular Optical Microresonators". His research interests are mathematical and computational aspects of optics, modeling and simulation of optical devices, and applied mathematical analysis.*