TIME RESOLVED MICROSCOPY OF LUMINESCENT NANODIAMONDS-MICROCAVITY SYSTEM

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Nanodiamonds (NDs) containing the color defects are non-toxic, hard and chemically stable making them a promising material for the applications in photonics and biology. One of the most commonly used color center is nitrogen vacancy (NV) [1]. NV centers exist in two different charge states: negative and neutral. The energy state of NV centers are such that they are used as qubits in quantum computing.

Whispering gallery modes (WGMs) are the resonating modes due to the total internal reflection in an optical resonator. These modes are sensitive to geometry and effective refractive index of the resonator making them applicable as sensors. The emitter couples with the resonator through a leaking field known as the evanescent field. When the emitter interacts with the WGMs, the spontaneous emission of the emitter gets modified as given by Purcell factor (F_P) [2].

In this work, NV center doped NDs have been used as an emitter and polymethyl methacrylate (PMMA) microspheres as WGM resonator. Simulations for the electric field distribution have been carried out for uncoated (Fig. 1(A)), uniformly coated (Fig. 1(B)) and a single particle on the microsphere (Fig. 1(C)). Fig. 1(D) shows the evanescent fields for each of the cases discussed above. The experimental results will be presented in the conference.

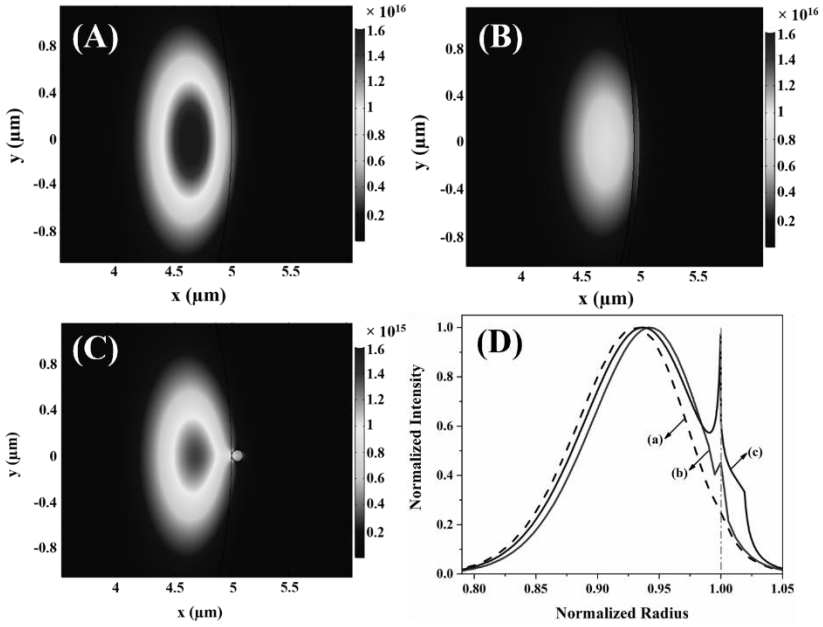

Figure 1 Electric field distributions of uncoated (A), uniform coating of thickness 50 nm (B) and 50 nm radius ND particle on the microsphere (radius = 5μm, refractive indices of microsphere and ND are 1.495 and 2.1 respectively). Colour bar shows the field strength. Panel D shows the evanescent fields for (A), (B) and (C) as plot (a), (b) and (c), respectively.

[1] A. D. Greentree, I. Aharonovich, S. Castelletto, M. W. Doherty, L. P. Mcguinness, and D. A. Simpson, "21st-Century Applications of Nanodiamonds," *OPN Opt. Photonics News*, pp. 21–25, 2010.

[2] E. M. Purcell, "Spontaneous emission probabilities at radio frequencies," *Physical Review*, vol. 69. p. 681, 1946.