

Dot-number effect on emission efficiency from randomized quantum dots in photonic nanocavity

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Quantum dots (QDs) embedded in a photonic nanocavity could lead to ultrahigh emission efficiencies [1]. However, there is a possibility of very large fluctuations in the efficiency among samples because the positions and energies of QDs in most practical system are random. This is due to their self-organized growth mechanism. In this study, we statistically simulate the emission efficiency for various numbers of QDs inside the cavity, taking into account of the randomness of the QDs as in Fig. 1. We have found that if the number of QDs inside the cavity is increased to ~ 100 , most samples show emission efficiencies over $\sim 10\%$. In addition, the interaction of carriers between QDs will further improve the efficiency to over $\sim 90\%$. The details will be explained at the symposium.

[1] S. Noda, *Science*, **314**, 260 (2006).

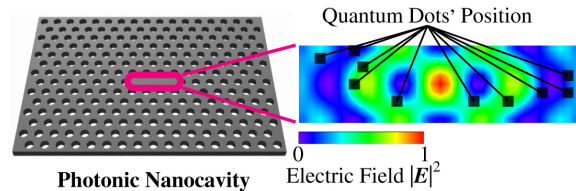


Fig. 1 Example of simulation model (QDs number : 10). QDs are placed at random positions inside nanocavity. The emission wavelength of the quantum-dot ensemble is assumed to have Gaussian distribution. From the electric field and emission wavelength of each QD, we can calculate the emission rate of each QD, and then obtain the emission efficiency.