Iterative tuning of InAs quantum dot emission wavelength by IR laser intermixing

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Controlling the emission wavelength of quantum dots (QDs) over large surface area wafers is challenging to achieve directly through epitaxial growth methods. We have investigated an innovative post growth laser-based tuning procedure of the emission of self-assembled InAs QDs grown epitaxially on InP (001). A targeted blue shift of the emission is achieved with a series of iterative steps, with photoluminescence diagnostics employed between the steps to monitor the result of intermixing. I will demonstrate tuning the emission wavelength of ensembles of QDs to within ±1 nm, and I will discuss the conditions required for achieving better tuning precision of emission wavelength of individual QDs. We estimate that with a laser source producing 5 μm diameter spots delivered, e.g., with an array of optical fibers, each coupled with individually controlled LEDs, the iterative laser annealing technique has the potential to offer an industrial process designed for automated precision tuning of the emission wavelength of equally distributed individual QDs whose density would be as large as 10^3–10^4 QDs per mm^2.

Short Bio:

Professor Jan J. Dubowski received his PhD degree in Semiconductor Physics from the Polish Academy of Sciences and the Wroclaw University of Technology, Poland. After working for over 20 years at the National Research Council of Canada, he joined the Department of Electrical and Computer Engineering of the Université de Sherbrooke, Canada where he leads advanced research focused on the physics and chemistry of surfaces and interfaces involving quantum semiconductors.