Epitaxially Lifted-Off Tensile Strained InAs Quantum Dots with Bimodal Size Distribution

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Tensile and compressive strains via epitaxial lift off (ELO) techniques were applied on InAs/GaAs quantum dots having a bimodal size distribution. The difference between the thermal expansion coefficients of the ELO film and the host substrate to which it is bonded results in the application of either biaxial compressive or tensile strain as the film is cooled to low temperatures[1].. This technique allows the application of variable strain on the same set of InAs quantum dots. At low temperatures InAs/GaAs quantum dots ELO film bonded to Si (MgO) will experience tensile (compressive) strain. Photoluminescence (PL) spectroscopy of the small dots reveals that the tensile strain red shifts the optical transition to as much as 20meV while compressive strain blue shifts by 13 meV with respect to the As-grown sample at 10 Kelvin. The magnitude of shifting is dependent on the dot size. A reversal in the PL intensity between emissions from the large sized and small size dots is also observed in the ELO film bonded on Si. We attribute this to the suppression of carrier thermalization[2] on both dots due to enhanced carrier confinement in tensile strained InAs films.

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[2]A. Patane, A. Levin, A. Polimeni, L. Eaves, P. C. Main and M. Henini, Phys. Rev. B. **62**, 11084 (2000)