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Quantum dots, DLTS spectroscopy of relaxed QDs and induced defeats, optical-controlled oscillator

This is a lab dedicated to the Molecular Beam Epitaxial growths of III-V compound semiconductor quantum-dot and quantum-well nanostructures with particular interests in their property transformation from coherently strained to relaxation in such nanostructures. We have developed several characterization techniques to analyze such variations such as Deep-level Transient Spectroscopy (DLTS), Admittance Spectroscopy, which can probe the electron emission times of these nanostructures and the induced defeat states as a function of sample depth. Figure 1 shows the DLTS emission spectra of defeat induced by the strain relaxation in the InAs QDs and, by a comparison with the TEM images we can identify their nature. Figure 2 shows a several-order magnitude elongation of the electron emission time from the InAs QDs as they change from coherently strained to strain relaxation. Figure 3 shows a red-shift of PL spectra as the InAs deposition thickness is increased and an abnormal blue-shift as the InAs thickness exceeded a critical thickness for strain relation, resulting in a bi-model co-existence of the QDs. Figure 4 shows the capacitance spectra of strongly confined QDs, which can be significantly modulated by light. We have implemented this in the applications of optical-controlled oscillator in which the oscillation frequency can be controlled by light intensity.

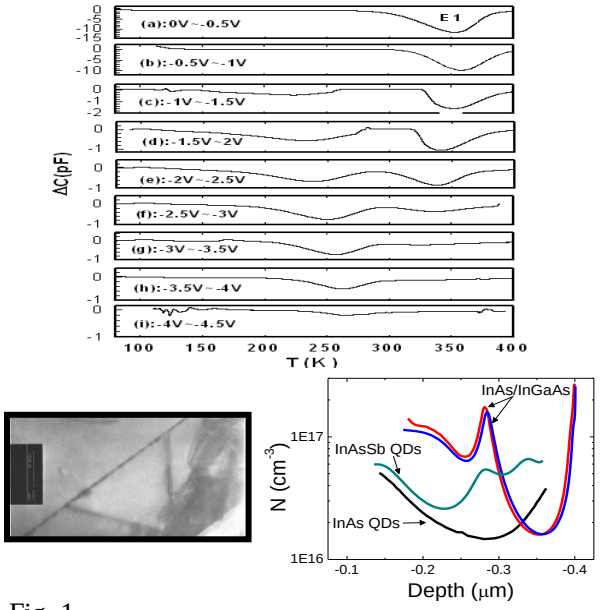

Fig. 1

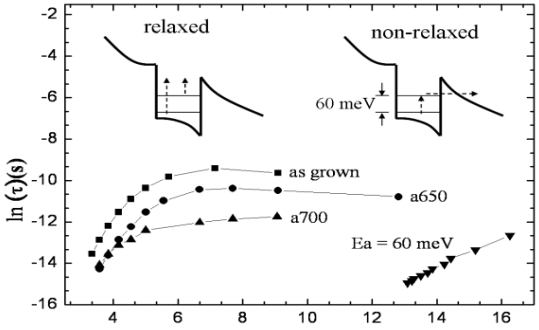

Fig. 2

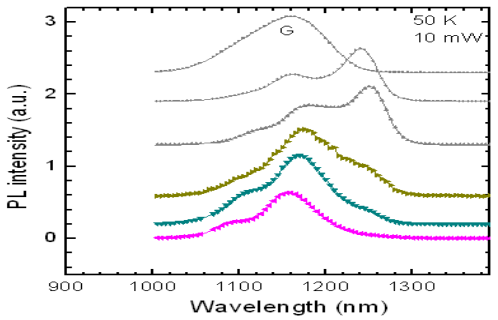

Fig. 3

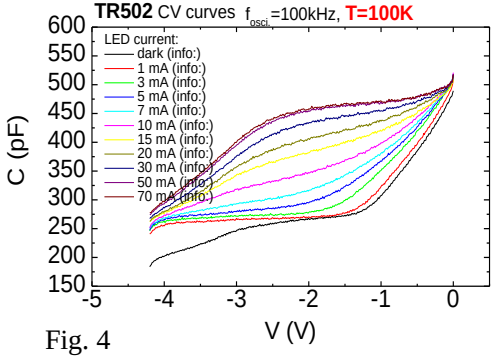

Fig. 4