THERMAL ACTIVATED CARRIER TRANSFER BETWEEN InAs QUANTUM DOTS IN VERY LOW DENSITY SAMPLES

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During the last decade, a great effort has been made studying the temperature evolution of QD emission, obtaining good agreements between experimental data and theoretical models [1]. Thermal escape through wetting layer (WL) or by phonon assisted tunneling is usually claimed to describe carrier transfer in monomodal and bimodal QDs distributions [2, 3, 4]. In the present study we have analyzed this phenomenon in two different samples containing a very low density of InAs/GaAs QDs, namely 16.5 and 25 QD/μm^2 (Samples I and II, respectively). A detailed experimental study as a function of temperature has been carried out by using ensemble photoluminescence (PL), micro-PL and time resolved PL (TRPL) techniques. In both samples coexist two QD size distributions: (i) a small size one emitting in the region 1.25-1.35 eV (SQD family) and (ii) a large size one emitting in the region 1.05-1.20 eV (LQD family), as shown in Figs. 1.a-b.

In sample I the SQD family dominates in intensity and the opposite is observed in Sample II, yet their temperature evolution is similar. An increase of the LQD integrated intensity is observed simultaneously with the decrease of the SDQ band, as observed in Figs. 1.c-d. This behavior is corroborated by the first time by Micro-PL of single QDs (see Fig. 1.e) belonging to both families detected simultaneously. The experiment is performed by using a multimode optical fiber in the detection arm of our confocal microscope and a monomode optical fiber to excite the SQD. A set of balance equations [1] is used to reproduce the measured temperature evolution of the whole PL spectrum by introducing the transfer between SQD towards neighbor LQDs via WL states and the measured TRPL data.

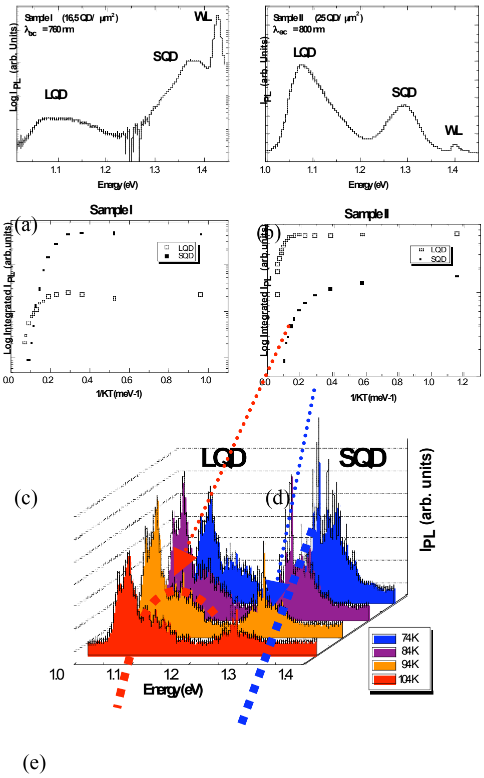

Figure 1

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