Effects of in-situ annealing process of GaAs (100) substrates on the subsequent growth of InAs quantum dots by molecular beam epitaxy

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In the present work, we study the growth by molecular beam epitaxy of InAs self-assembling quantum dots (SAQDs) on GaAs (100) substrates subjected to an in-situ annealing treatment. The annealing process consists on the exposition of the GaAs buffer layer surface to high temperatures for a few seconds with the shutter of the Arsenic-Knudsen cell closed. The purpose is to obtain a better uniformity on the SAQDs sizes. In our study we prepared different samples using the Stransky-Krastanov growth mode to obtain InAs/GaAs (100) quantum dot samples with different annealing time- and temperature. Their structural and optical properties were studied by reflection high-energy electron diffraction, scanning electron microscope (SEM), atomic force microscope (AFM), and photoreflectance spectroscopy (PR). According to the results of AFM and SEM, with the thermal treatment we obtained a better distribution of the quantum dot sizes in comparison with a reference sample with no treatment. The PR spectra from 0.9 to 1.35 eV presented two transitions associated to SAQDs. The energy transitions were obtained by fitting the PR spectra using the third derivate model Aspnes.

Keywords: InAs, Quantum dots, Reflection High Energy Electron Diffraction (RHEED), Atomic Force Microscopy (AFM), High-Resolution Scanning Electronic Microscopy (HRSEM), Photoreflectance.

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