Porous PolySiGe Nanoestructures Formed by Electrochemical Processes

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The most significant advantages of using SiGe alloys instead of Si in porous nanoestructures are, among others, the reduction of lifetime for exciton recombination and the increment of radiative recombination efficiency. Also, it has been recently reported that luminescent emission from porous layers formed using poly Si and monocrystalline Si are very similar. Therefore, the possibility of using polycrystalline SiGe of different compositions appears to be a very attractive option.

Amorphous SiGe layers, 250 nm thick, were deposited by LPCVD on Si wafers and crystallized at 650° C. The Ge fraction of the layers was in the range of 0 to 0.7. The porous poly-SiGe layers nanostructures were formed by the electrochemical etch in FH:Ethanol (2:1) with a current density of 50 mA/cm2. The samples were illuminated with white light during the etching process. The composition of the porous layers was measured by EDX. The rms roughness and surface morphology were determined by SEM and AFM as a function of the composition of the layers and the electrochemical formation process parameters. Raman spectroscopy was used to estimate size effects and composition. The luminescence was studied by cathodoluminescence (CL), and its uniformity was determined by CL imaging. Finally, a relation between the morphology of the nanostructured poly-SiGe layers and the luminescence and Raman spectra of these structures is discussed.