

Optical Characterization of Erbium-Mixed Silicon Nanocrystals

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Abstract : The structural characterization of silicon nano crystals (SiNCs) have been carried out using transmission electron microscope (TEM) and atomic force microscopy (AFM). SiNCs are crystalline with an average diameter of 65 nm. Erbium trichloride was added to silicon nano crystals using a simple chemical procedure. Erbium is useful in this context because it has a narrow emission band at 1536 nm which corresponds to a standard optical telecommunication wavelength. The optical properties of SiNCs and erbium-mixed SiNCs samples have been characterized using UV-vis spectroscopy, confocal Raman spectroscopy and photoluminescence spectroscopy (PL). SiNCs and erbium-mixed SiNCs samples exhibit an orange PL emission peak at around 595 nm that arise from radiative recombination of Si. Erbium-mixed SiNCs also shows a weak PL emission peak at 1536 nm that attributed to the intra-4f transition in erbium ions. The intensity of the PL peak of Si in erbium-mixed SiNCs is increased in the intensity up to $\times 3$ as compared to pure SiNCs. It was observed that intensity of 1536 nm peak decreased dramatically in the presence of silicon nano crystals and the PL emission peak of silicon nano crystals is increased. Therefore, the resulted data present that the energy transfer from erbium ions to SiNCs due to the chemical mixing method which used in this work.

Keywords : Silicon Nanocrystals (SiNCs), Erbium Ion, photoluminescence, energy transfer

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