AL-DOPING IMPACT ON EMISSION AND STRUCTURE OF ZnO NANOCRYSTAL FILMS

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The morphology, structure and emission of Al-doped ZnO nanocrystals (NCs) with the different Al contents (1-4at%) were studied by means of scanning electronic microscopy (SEM), energy dispersive X-ray spectroscopy (EDS), X-ray diffraction (XRD) and photoluminescence (PL) methods. Ultrasonic spray pyrolysis was applied to obtain the ZnO:Al films. To stimulate the crystallization, the ZnO:Al films were annealed at 400 °C for 4h in a constant nitrogen flow (8L/min). It is shown that the Al incorporation in the ZnO films with the concentrations of 2-4at% stimulates: reducing ZnO grain sizes, decreasing the film crystallinity owing to disordering the ZnO crystal lattice, as well as the change of surface morphology and increasing the surface roughness. Meanwhile Al-doping the ZnO film at the concentrations ? 2at% enlarges significantly the PL intensity of near band edge (NBE) emission. Last fact testifies on quality improving the ZnO:Al films. Simultaneously, the PL intensities of green and orange PL bands, connected with the native defects: V$_{Zn}$ and O$_{P}$, respectively, fall down. The ZnO NC films with Al-doping ? 2at% still keep the planar surface morphology that is important for their application in electronic device structures.

Keywords: ZnO:Al nanocrystals, photoluminescence, defects

Acknowledgment:

The authors thank the Secretary of Investigation and Postgraduate Study at National Polytechnic Institute (projects 20180495) and National Council of Science and Technology (CONACYT) of Mexico (project 258224) for the financial support.

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