IR PHOTOCONDUCTORS OF UNDOPED AND DOPED PBS NANOSTRUCTURES GROWN BY A CVD METHOD

YOUSEFI Ramin, CHERAGIZADE Mohsen

Islamic Azad University, Masjed-Soleiman, Islamic Republic of Iran

Abstract

Undoped, anionic-, and cationic-doped PbS nanostructures were grown using a thermal evaporation method as infrared (IR) detectors. Zinc and selenium were used as cationic and anionic dopant materials. Scanning electron microscopy (SEM) results showed similar morphologies for the undoped and doped PbS nanostructures. X-ray diffraction (XRD) patterns of three sets of the nanostructures indicated that these nanostructures had a PbS structure with a cubic phase. Room temperature photoluminescence (PL) spectrometer was used to study optical properties of the undoped and doped-PbS nanostructures. Optical characterization showed that emission peaks were in the IR region of the electromagnetic spectrum for all PbS nanostructures. In addition, the optical studies of the doped PbS nanostructures revealed that the band gap of the PbS nanostructures was affected by these dopant materials. Photoconductor devices for infrared (IR) light detection were fabricated by depositing gold electrodes as ohmic metal contacts. Linear characteristics were obtained from current-voltage (I-V) measurements that showed response to IR illumination. The I-V results showed that the Zn-doped PbS nanostructures had less resistivity under dark and IR illumination conditions in comparison to the undoped and Se-doped PbS nanostructures. Finally, the photoresponse properties of the undoped and doped PbS nanostructures were studied by an infrared source under different bias voltage conditions. The results showed that Zn-doped PbS nanostructures as an IR detector had higher current amplitude in comparison to the other PbS nanostructures.

Keywords: PbS nanostructures, Anionic dopant, Cationic dopant, Thermal evaporation, IR detector, Photocurrent

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