Synthesis and Characterization of Electro-spin Deposited Perovskite Nanostructures for Solar Cell Application

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Abstract

Perovskite nanostructures have been prepared via electrospinning technique using polyvinyl alcohol and methylammonium lead iodide ($CH_3NH_3PbI_3$ – perovskite). In the electrospinning experiment, the formation of different nanostructures was observed for different applied voltages (0-D nanodots for 10 kV, 1-D nanofibers for 20 kV, and 3-D nanocubes for 30 kV). The X-ray diffraction pattern of the samples synthesized, revealed the existence of perovskite nanostructures with tetragonal phase. The energy dispersive X-ray analysis indicates the stoichiometric presence of lead, iodine, carbon and nitrogen in the synthesized perovskite materials. The absorbance spectra have been also recorded and consequently, the optical band gap energy was found to be in the range of 1.45 to 1.52 eV which is quite close to the optimum theoretical value (1.5 eV) required for solar cell application for interfacial absorber materials. The photoluminescence spectra of the prepared methylammonium lead iodide perovskites exhibited a broad band at 780 nm which corresponds to the band-to-band transition of the perovskite nanostructures. Hence, the perovskite nanostructures synthesized could be possibly used as an interfacial modifier in perovskite solar cells for enhancing the charge transport between the active absorber layer and the transporting layers.

Keywords: Perovskite nanostructures, lectro-spin deposition, Interfacial modifier, Absorbance layer, Energy bandgap