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Synthesis and properties of p-si/n-$cd_{1-x}ag_x$o heterostructure for transparent photodiode devices(Article)(Open Access)

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Abstract

We developed silver-doped $Cd_{1-x}Ag_xO$ thin films (where x = 0, 0.01, 0.02, 0.03 and 0.04) on amorphous glass substrate by an automated nebulizer spray pyrolysis set-up. The XRD patterns show rock salt cubic crystal structures, and the crystallite sizes vary with respect to Ag doping concentrations. SEM images exhibited a uniform distribution of grains with the addition of Ag; this feature could support the enhancement of electron mobility. The transmittance spectra reveal that all films show high transmittance in the visible region with the observed bandgap of about 2.40 eV. The room temperature photoluminescence (PL) studies show the increase of near-band-edge (NBE) emission of the films prepared by different Ag doping levels, resulting in respective decreases in the bandgaps. The photodiode performance was analyzed for the fabricated p-Si/n-$Cd_{1-x}Ag_xO$ devices. The responsivity, external quantum efficiency and detectivity of the prepared p-Si/n-$Cd_{1-x}Ag_xO$ device were investigated. The repeatability of the optimum (3 at.% Ag) photodiode was also studied. The present investigation suggests that $Cd_{1-x}Ag_xO$ thin films are the potential candidates for various industrial and photodetector applications.

Author keywords

$Cd_{1-x}Ag_xO$ thin films | P-Si/n-$Cd_{1-x}Ag_xO$ | Photodiode | PL

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