Document details - Effect of Zn doping on structural, morphological, optical and electrical properties of nebulized spray-deposited CdO thin films

Applied Physics A: Materials Science and Processing

Volume 124, Issue 8, 1 August 2018, Article number 561

Effect of Zn doping on structural, morphological, optical and electrical properties of nebulized spray-deposited CdO thin films(Article)

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Abstract

Transparent and conducting pure and Zn-doped CdO thin films (0, 1, 2, 3 and 4 at.% Zn) have been successfully deposited on glass substrates at optimized substrate temperature of 200 °C by spray pyrolysis technique using nebulizer. Structural, morphological, optical and electrical properties of pure and Zn-doped CdO thin films are studied in detail. X-ray diffraction study confirms that all the CdO thin films were polycrystalline in nature with major reflection alone (111) plane having a cubic structure. The high average grain size (345 nm—SEM) and low RMS (6.46 nm—AFM) values are obtained for 3 at.% Zn-doped CdO thin films. The optical band gap energy had increased from 2.49 to 2.57 eV as the function of doping concentration had increased from 1 to 3 at.% Zn and thereafter decreased for higher doping concentration. A strong green emission and slightly shifted for Zn-doping concentration of CdO thin films exhibited by photoluminescence spectra. The CdO bond vibration confirmed by FTIR and Raman analyzes. The resistivity value of un-doped CdO thin film is 1.06×10^{-3} Ω cm and adding Zn-doped concentration, the resistivity consequently decreased to 6.2×10^{-4} Ω cm for 3 at.% Zn-doped CdO thin films and then furthermore increased. A high-quality factor (7.07×10^{-2}) was obtained for 3 at.% Zn-doped CdO thin films.

Indexed keywords

Engineering controlled terms: Conductive films | Energy gap | Fourier transform infrared spectroscopy | Optical films | Photoluminescence | Semiconductor doping | Spray pyrolysis | Substrates | Thin films | Vibration analysis | Zinc | Zinc compounds

Engineering uncontrolled terms: Doping concentration | High quality factors | Optical and electrical properties | Optical band gap energy | Photoluminescence spectrum | Spray-pyrolysis techniques | Substrate temperature | X-ray diffraction studies

Engineering main heading: Cadmium compounds

ISSN: 09478396
CODEN: APAMF
Source Type: Journal
Original language: English
DOI: 10.1007/s00339-018-1993-7
Document Type: Article
Publisher: Springer Verlag

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