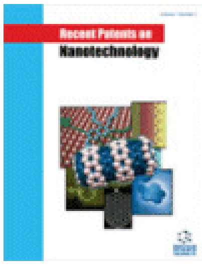
Home / Recent Patents on Nanotechnology, Volume 10, Number 1



Nanostructured SnO2 –Ge Multi-layer thin Films with Quantum Confinement Effects for Solar Cell

Authors: Faheem Khan, Abdul; Sajjad, Wasim; A. Rahim, Nasrudin

Source: Recent Patents on Nanotechnology, Volume 10, Number 1, April 2016, pp. 77-82(6)

Publisher: Bentham Science Publishers

previous article

view table of contents

next article

ADD TO FAVOURITES

Abstract:

Background: It is well-known that multi-layer films with nanostructure can give novel properties by interfacial phenomenon and quantum confinement effects. Nanostructured multi-layer thin films are presently being analyzed for their vast applications in the area of optoelectronics technology particularly photovoltaics. Hereof, two dimensional thin films with nanostructure are of prime importance due to their structure dependent optical, electrical, and opto-electronic properties. It has been revealed that these films exhibit quantum confinement effects with band gap engineering. The main focus of the research is to evaluate the effect on structural and optical properties with number of layers.

Methods: Nanostructured SnO2-Ge multi-layer thin films were fabricated using electron beam evaporation and resistive heating techniques. Alternate layers of SnO2 and Ge were deposited on glass substrate at a substrate temperature of 300 °C in order to obtain uniform and homogeneous deposition. The substrate temperature of 300 °C has been determined to be effective for the deposition of these multi-layer films from our previous studies. The films were characterized by investigating their structural and optical properties. The structural properties of the as-deposited films were characterized by Rutherford Backscattering Spectroscopy (RBS) and Raman spectroscopy and optical properties by Ultra-Violet-Near infrared (UV-VIS-NIR) spectroscopy.

Results: RBS studies confirmed that the layer structure has been effectively formed. Raman spectroscopy results show that the peaks of both Ge and SnO2 shifts towards lower wavenumbers (in comparison with bulk Ge and SnO2, suggesting that the films consist of nanostructures and demonstrate quantum confinement effects. UV-VIS-NIR spectroscopy showed an increase in the band gap energy of Ge and SnO2 and shifting of transmittance curves toward higher wavelength by increasing the number of layers. The band gap lies in the range of 0.9 to 1.2 eV for Ge, while for SnO2, it lies between 1.7 to 2.1 eV.

Conclusion: Analysis of results suggests that the nanostructured SnO2-Ge multi-layer thin film can work as heterojunction materials with quantum confinement effects. Accordingly, the present SnO2-Ge multi-layer films may be employed for photovoltaic applications. Few relevant patents to the topic have been reviewed and cited.

Keywords: Electron beam evaporation; Rutherford backscattering; SnO2-Ge multi-layer thin films; photovoltaics; quantum confinement effect; resistive heating

Document Type: Research Article

Publication date: April 1, 2016

More about this publication?
