Nanostructure Lanthanum Doped Zinc Oxide Optical Materials

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JOURNAL OF NANOELECTRONICS AND OPTOELECTRONICS
Volume: 9 **Issue:** 5 **Pages:** 624-634 **Special Issue:** SI
DOI: 10.1166/jno.2014.1645
Published: OCT 2014
View Journal Impact

Abstract

Transition-metal-doped ZnO is considered a promising candidate for applications in spintronics. Thin films of ZnO at different Lanthanum (La) doping concentration varied from 1 to 4 wt% have been synthesized via a new facile sol gel route using the spin coating approach. X-ray diffraction patterns of the films showed that the pure ZnO and La-doped ZnO films exhibited hexagonal wurtzite crystal structure with a preferred orientation along (002) direction. The crystallite size, lattice constants, lattice strain, defect density and crystallinity of the films depending on La wt%. Surface morphology of the films obtained by atomic force microscopy (AFM) and transmission scanning microscopy (TEM) revealed that films grew as nano-spherical shaped with diameters varying between 18 to 20 nm dependent on La wt%. The optical transmittances of all films are highly transparent in the visible wavelength region with an average transmittance of about 91%. The optical energy gap increased from 3.30 to 3.33 eV with an increase in the concentration of La-doping. The optical constants such as refractive index, extension coefficient, real and imaginary dielectric constant of La doped ZnO films were also estimated. The dc electrical conductivity of the films increases with the increasing in La wt%. These new simple low-cost approach should promise us a future large-scale growth of metal oxides nanostructures for potential applications in optoelectronics.

Keywords

Author Keywords: La Doped ZnO Nanoparticles; Sol-Gel; Thin Films; Microstructure; Optical and Electrical Properties
KeyWords Plus: ZNO THIN-FILMS; NANOPARTICLES

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Publisher

AMER SCIENTIFIC PUBLISHERS, 26650 THE OLD RD, STE 208, VALENCIA, CA 91381-0751 USA

Categories / Classification

Research Areas: Engineering; Science & Technology - Other Topics; Physics

Web of Science Categories: Engineering, Electrical & Electronic; Nanoscience & Nanotechnology; Physics, Applied

Document Information

Document Type: Article

Language: English

Accession Number: WOS:000352332300010

ISSN: 1555-130X

eISSN: 1555-1318

Journal Information

Table of Contents: Current Contents Connect

Impact Factor: Journal Citation Reports

Other Information

IDS Number: CF1UB

Cited References in Web of Science Core Collection: 18

Times Cited in Web of Science Core Collection: 3