文献

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Structural, electronic, and optical properties of nanocrystalline As-doped ZnO films on quartz substrates determined by Raman scattering and infrared to ultraviolet spectra
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抄録 (Abstract)
Nanocrystalline As-doped ZnO films with different laser power energy (40 mJ and 55 mJ) and As doping concentrations (CAs from 1% to 3%) have been grown on quartz substrates by pulsed laser deposition. The average grain size of the films was calculated from the (002) peak of x-ray diffraction patterns and is estimated to vary from 9 to 13 nm. Electronic transitions and optical properties of the films have been investigated by Raman scattering, far-infrared reflectance, and infrared-ultraviolet spectral transmittance technique. With increasing doping concentration, the A1 longitudinal optical phonon mode shifts towards the lower energy side and can be described by (564-75CAs) cm-1 owing to the increment of free carrier concentration. The E1 transverse optical phonon frequency is located at about 415 cm-1 and does not show an obvious decreasing trend with the CAs. The optical constants in the photon energy range of 0.5-6.5 eV have been extracted by fitting the experimental data with the Adachi's model. The refractive index dispersion in the transparent region can be well expressed by a Sellmeier's single oscillator function. Due to different doping concentration and hexagonal crystalline structure, the optical band gap of the films grown at 40 mJ linearly decreases with increasing As concentration. The phenomena agree well with the results from the theoretical calculations.

著者キーワード
Arsenic doped Zinc Oxide; Nanocrystalline Films; Optical Spectroscopy; Pulsed Laser Deposition; Raman Spectroscopy; X-ray Diffraction

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