Determination of the energy band-gap of the ceramic ZnO -xTiO_2 using photopyroelectric spectroscopy

Abstract

Photopyroelectric (PPE) spectroscopy is a useful tool for examining optical properties in semiconductor materials. The ceramic (ZnO - xTiO_2) was sintered at 1270^0C for 1 and 3 hours to investigate the variations of energy band-gap with respect to mol % of dopant TiO_2. The X-ray diffractrometry shows that the crystal structure of ZnO doped at low level remains to be of hexagonal type but has developed second phase, Zn_2TiO_4, at high level. Microstructure and compositional analysis of the selected areas are analyzed using SEM and EDAX. The maximum grain size obtained were 26.8, 52.4 μm at 0.4 mol % of TiO_2 for 1 and 3 hours sintering time, respectively. The band-gap determined from the photopyroelectric spectrum has the value of 2.82 ± 0.01 eV for samples sintered for 1 and 3 hours at the doping level of 0.4 mol % of TiO_2 and decreases with the increase of TiO_2.

Keyword: Photopyroelectric spectroscopy; Energy band-gap; Ceramic ZnO -xTiO2; Semiconductor material