

Effect of hydrothermal growth temperature and time on physical properties and photoanode performance of ZnO nanorods

ABSTRACT

Well aligned zinc oxide (ZnO) nanorods (NRs) on ITO substrate for photoelectrochemical application were synthesized successfully through two steps preparation which consisted of deposition ZnO NPs by sol-gel spin coating at 3000 rpm for 40 sec. then followed by cost-effective simple hydrothermal method. The study investigates the effect of growth temperature and duration on the optical properties, photoconversion efficiency, and morphological structure of ZnO/ITO NRs. The hydrothermal temperature was varied between 80 °C to 120 °C and the growth time between 1 to 5 hours. The results of X-ray diffraction showed that the samples had a single hexagonal phase with a strong (002) preferred orientation. ZnO NRs prepared at 110 °C showed the highest diffraction peak intensity with crystallite size of 30.07 nm which implies the excellent crystallinity obtained at this temperature. FE-SEM proved that the temperature and growth time critically affect the diameter and the length of NRs. Photocurrent density of 0.337 mA/cm² at +0.5 V vs Ag/AgCl reference electrode shown by ZnO NRs photoelectrode prepared at 110 °C for 4 hours which is about 8 times greater than ZnO nanoparticles.

Keyword: Hydrothermal method; Hydrothermal growth temperature; Growth time; ZnO nanorods