Effect of post-hydrothermal treatments on the physical properties of zno layer derived from chemical bath deposition

Amalia Sholehah, author

Abstrak

Among semiconductors, zinc oxide (ZnO) has received great attention due to its wide band-gap and high electron mobility, resulting in various strategic applications. Controlling the physical properties of ZnO is therefore a critical issue in the fabrication of related electronic and optical devices. In this study, ZnO nanorods layers were grown on an ITO glass substrate via chemical bath deposition at low temperature. Prior to the growing process, the layers were deposited using a spin-coating technique. The seeding solution was made by dissolving zinc nitrate tetrahydrate and hexamethylene tetraamine in cold water (0oC) for an hour using a cooler bath. The as-synthesized ZnOs were further subjected to different post-hydrothermal treatment series at a temperature of 150oC for three hours at atmospheric pressure and at 100°C for one hour under one bar of nitrogen gas (N2) pressure. The characterization was performed using scanning electron microscopy (SEM), atomic force microscopy (AFM), X-ray diffraction (XRD), and UV-Vis spectroscopy. The SEM results showed that the ZnO nanorods were grown as a vertically aligned hexagonal structure, while the XRD patterns showed a high intensity at the (002) plane. On the basis of investigation, it was found that under post-hydrothermal treatment at 150oC for three hours with atmospheric pressure, the synthesis procedure resulted in nanostructures in the form of ZnO rods. Meanwhile, post-hydrothermal treatment at 100°C for one hour under one bar of nitrogen gas (N2) produced ZnO rods and tubes. In general, the post-hydrothermal process provided a high degree of crystallinity. The optimum ZnO layer was obtained after post-hydrothermal treatment at 150oC for three hours at atmospheric pressure, with a crystallite size and band-gap energy of ~18 nm and 3.20 eV, respectively.