

Study of frequency dependent electrical properties of ZnO nanorods

Abstract

Purpose - The purpose of the current research is to use impedance spectroscopy to study the AC parameters that varied with frequency such as impedance, dielectric constant and conductivity of ZnO nanorods MSM structure in the range of 1Hz to 10MHz under atmospheric conditions. **Design/methodology/ approach** - ZnO nanorods were grown on glass substrate using low cost sol-gel method. 0.35M seed solution was prepared by dissolving zinc acetate dihydrate in 2-methoxyethanol and monoethanolamine which acts as a stabilizer was added drop-wise. Prior to the deposition, glass slide was cut into pieces of 1.5cm×2cm. Ultrasonication process is used to clean the glass substrate using acetone, ethanol, and de-ionized (DI) water for 5min. The prepared seed solution was coated on glass substrate using spin coater at spinning speed of 3000rpm for 30s and then dried at 250°C for 10min followed by annealing at 550°C for 2h. The hydrothermal growth was carried out in aqueous solution of zinc nitrate hexahydrate (25mM), hexamethyltetramine (25mM). **Findings** - ZnO nanorods were characterized using scanning electron microscope (SEM), X-ray diffraction (XRD) and impedance spectroscopy. The real part of impedance (Z') showed two semicircles that correspond to the distribution of the grain boundaries and electrode process. SEM image showed the densely packed ZnO nanorods on the surface of glass substrate, whereas XRD revealed the grown nanorods have c-axis orientation. The results show that the impedance dielectric increases as the frequency decreases while the conductivity showed the opposite behavior. **Originality/value** - This paper demonstrates the electron transport mechanism of ZnO nanorods at room temperature to understand the frequency dependent parameters.

Keywords

Dielectric; Dielectric properties; Electrical impedance; Impedance; Sol-gel; ZnO nanorods