

Fabrication and characterization of ZnO thin films by sol-gel spin coating method for the determination of phosphate buffer saline concentration

Abstract

The fabrication, characterization and application of nanostructured zinc oxide (ZnO) thin films on interdigitated silver electrodes were described for the determination of phosphate buffer saline (PBS) concentration. The ZnO thin films were synthesized on a silicon dioxide wafer using a sol-gel spin coating technique. Two different seed solutions were prepared by dissolving Zn-acetate dihydrate in methanol and isopropanol in presence of a stabilizer, monoethanolamine. The field emission scanning electron microscope, atomic force microscope, X-ray diffractometer and Fourier transform infrared characterization revealed the presence of hexagonal ZnO nano-crystals in all thin films. However, the smaller sized and homogeneous ZnO nano-crystals were observed in isopropanol derived thin films. These thin films were used to discriminate the concentrations of different PBS solutions and the discriminatory signals were captured using a low-cost dielectric analyzer and a source meter. The frequency-capacitance curve reflected 2.85 fold increase in capacitance values when the sensor was exposed to 1000-fold diluted PBS in deionized water. A change in PBS concentration from 1000 fold to 10 fold increased the current flow from 6 μ F to 122 μ F. Thus the capacitance and current flow demonstrated a proportional relationship with the concentration of PBS, suggesting the application of the fabricated sensor in the determination and discrimination of chemicals species concentration in various solutions.

Keywords

Dielectric analyzer and source meter; Double layer capacitance; I-V curve; Interdigitated electrodes; Sol-gel spin coating technique