Effect of silver doping on the microstructural and electrical properties of ZnO nanorods prepared by hydrothermal growth

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ABSTRACT

In this study, silver-doped zinc oxide (Ag-doped ZnO) nanorods which were prepared by hydrothermal growth on n-type silicon substrate were fully characterized. First, a seeding layer was formed on silicon substrate by spin coating with a mixed solution of 0.02M zinc acetate (Zn(CH$_3$COO)$_2$∙2H$_2$O) and 1M ethanolamine (NH$_2$CH$_2$OH) dissolved in 20 ml of methanol (CH$_3$OH). Subsequently, a mixed solutions of 0.02M hexamethylenetetramine (C$_6$H$_{12}$N$_4$), 0.02M zinc nitrate hexahydrate (Zn(NO$_3$)$_2$‧6H$_2$O), and silver nitrate (AgNO$_3$) of various concentrations were prepared. And the growth of ZnO was carried out in the mixed solution at 90˚C for two hours. As observed from field-emission scanning electron microscope (FE-SEM), the synthesized ZnO are hexagonal nanorods indeed. The chemical components of Ag-doped ZnO nanorods were determined from energy diffraction spectroscopy (EDS) to be zinc, oxygen, and silver. As expected, the conductivity type for Ag-doped ZnO nanorods is p-type as was determined from Hall effect measurement. The lowest resistivity 1.425 Ω-cm is obtained for ZnO nanorods synthesized at a doping level of 2.0% AgNO$_3$. In addition, ultraviolet photoluminescence (PL) characteristic peaks located in the range between 379 nm and 382 nm were found for Ag-doped ZnO nanorods.

Keywords: silver-doped zinc oxide, Hall effect measurement, photoluminescence (PL)

REFERENCES


