Fabrication of ZnO Nanostructures and Their Nanodevices Applications

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ZnO recognizes itself as one of the effective materials for efficient nanodevices due to its diverse properties. We present the fabrication of ZnO nanostructures and their applications for field effect transistors, field emission devices, nanorods-based p-n junction diodes, and chemical and bio sensors. The field-emission characterization of the as-grown aligned hexagonal nanorods shows that a turn-on field was 5.8 V/μm and the emission current density reached to 0.061 mA/cm^2 at an applied electrical field of 9.0 V/μm and shows no saturation. The ZnO nanorods-based p-n junction device (Al/n-ZnOnanorods/p-Si) showed good rectifying behavior and allows high current in the order of mA even at lower voltages. This device also exhibited nearly stable behavior in the temperature range of 20-150 ^{o}C since the variation of series resistance of the device with temperature is marginal. Using ZnO nanonails, a hydrazine sensor has been fabricated, for the first time, which showed a high and reproducible sensitivity of 8.56μA cm^{-2}μM^{-1} with a response time less than 5s, having a low detection limit of 0.2μM. The fabricated glucose sensor also showed a high sensitivity of 24.6μAcm^{-2}mM^{-1} with a response time less than 10s with a detection limit of 5μM.