

Synthesis and characterization of zinc oxide nanorods on silicon for the fabrication of p-Si/ n-ZnO heterojunction diode

R. I. Badran^{1, 2}, Ahmad Umar^{3, 4}, S. Al-Heniti¹, A. Al-Hajry^{4, 5}, T. Al-Harbi¹

¹Department of Physics, Faculty of Science, King Abdulaziz University, Saudi Arabia, ²Physics Department, The Hashemite University Zarqa, Jordan, ³Department of Chemistry, Faculty of Science, Advanced Materials and Nano-Engineering Laboratory (AMNEL), ⁴Centre for Advanced Materials and Nano-Engineering, Najran University, Saudi Arabia, ⁵Department of Physics, Faculty of Science, Najran University, Saudi Arabia

Abstract:

Hexagonal-shaped ZnO nanorods were successfully grown on p-silicon substrate via thermal evaporation of metallic zinc powder in the presence of oxygen. The grown nanorods were characterized in terms of their structural and optical properties by using X-ray diffraction, FESEM, HRTEM and room-temperature photoluminescence (PL) spectroscopy. It is confirmed from the observed structural and optical properties, that the grown nanorods are well-crystalline with the wurtzite hexagonal phase and are preferentially grown along the [0001] direction and exhibiting good optical properties. The as-grown n-ZnO nanorods on p-silicon (n-ZnO/p-Si) substrate were used to fabricate p-n heterojunction diode which attains a turn-on voltage of ~ 0.5 V. Temperature-dependant (298, 323, 343, 363, 383, and 423K) I-V characteristics for the fabricated diode were also examined and demonstrated in this paper. It was found that the fabricated heterojunction diode was reasonably stable at higher temperatures and the series resistance slightly increases with increasing the temperature.