Position and Density Controlled Growth of 1D ZnO Nanorods for Novel Nanodevice Applications

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We have demonstrated a novel and scalable process for the growth of high-quality and uniform ZnO nanorod arrays in which position of nanorods and shape precisely controlled. The synthesis of ZnO nanorod arrays was carried out using zinc nitrate hexahydrate and hexamethylenetetramine at low temperature of 70oC. The pattern and growth locations of nanorods are defined by the electron beam lithography. The alignment and orientation of nanorods are determined by solution growth process. Field emission scanning electron microscopy analysis of ZnO nanorods shows that the as-grown nanorods are uniform and perfectly aligned on the patterned substrate. The diameter and length of nanorods is found to be ~75±15 and ~350±100 nm, respectively. By changing precursor concentration, a significant change in the density of aligned ZnO nanorods has been observed. Structural analysis reveals that the as-grown nanorods are single crystalline in nature and grown along c-axis direction. The photoluminescence studies of nanorods shows a sharp ultra violet emission at a wavelength of ~381 nm and a broad deep-level visible emission at ~580 nm.