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Synthesis and characterization of ZnO nanorod array and heteronanostructures using low temperature solution method

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Recently, one-dimensional (1D) nanomaterials have attracted much attention due to their potential applications as building blocks in the fabrication of various nanoelectronic and nanophotonic devices. Zinc oxide (ZnO) is n-type semiconductor material with wide direct bandgap (3.4 eV) and large exciton binding energy (60 meV). This material has many interesting properties such as transparent, piezoelectric and photocatalytic properties. Due to these characteristics, ZnO nanowires have been used in development of various nanodevices such as field effect transistor (FET), chemical sensor, light emitting diode (LED), field emission display (FED) and solar cell.

We have demonstrated fabrication of ZnO nanorod array on the substrate in large wafer-scale using novel solution method. Very uniform, single crystalline ZnO nanorod array was synthesized by this low temperature solution method. Typical growth temperature was lower than 90 °C. The crystal structures and optical properties of ZnO nanorods were investigated using various characterization techniques including XRD, SEM, EDS, HR-TEM and PL. The selective growth of nanorods was also studied using photolithography.

Heteronanostructure of ZnO nanorods were synthesizedby two-step processes. Various heterostructures were studied such as SiC-ZnO, Co_3O_4-ZnO and CdS-ZnO nanorods. These bifunctional materials have demonstrated many interesting properties. The detailed synthesis and characterization of the heteronanostructures will be presented.