

Non-catalytic growth of ZnO nanostructures on silicon by vapor-solid mechanism: structural and optical properties

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Different ZnO nanostructures such as hexagonal nanotowers, nanowires attached to nanosheets, nanorods, nano and micro cages and tubes, micro-flowers containing nanosheets, urchin like structures containing nanowires etc, have been synthesized without the use of any metal catalyst or additives on the silicon substrate by the thermal evaporation of metallic zinc powder in a single reactor chamber. It was observed that distance of the substrate from Zn source and the substrate temperature as well as pretreatment step also plays an important role in the morphology of the deposited structures and specific structures can be obtained at specific temperature zone, with or without pretreatment step in the furnace. High resolution transmission electron microscopy and selected area electron diffraction patterns revealed that the deposited structures are single crystalline and grew along the [0001] direction. Appearance of sharp, strong and dominant E2 mode and suppressed E1(LO) mode in Raman spectra, for all the cases, indicated that the grown ZnO nanostructures have good crystal quality with the hexagonal wurtzite phase.