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Effect of ON/OFF Cycles of Ar Gas on Structural and Optical Properties of ZnO Nanostructure Grown by Vapor Phase Transport

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ZnO nanostructures were synthesized by a vapor phase transport process in a single-zone furnace within a horizontal quartz tube with an inner diameter of 38 mm and a length of 485 mm. The ZnO nanostructures were grown on Au-catalyzed Si(100) substrates by using a mixture of zinc oxide and graphite powders. The growth of ZnO nanostructures was conducted at 800^{o}C for 30 min. High-purity Ar and O_2 gases were pushed through the quartz tube during the process at a flow rate of 100 and 10 sccm, respectively. The sequence of ON/OFF cycles of the Ar gas flow was repeated, while the O_2 flow is kept constant during the growth time. The Ar gas flow was ON for 1 min/cycle and that was OFF for 2 min/cycle. The structure and optical properties of the ZnO nanostructures were investigated by field-emission scanning electron microscope, X-ray diffraction, temperature-dependent photoluminescence. The preferred orientation of the ZnO nanostructures was along c-axis with hexagonal wurtzite structure.

Keywords: ZnO, Vapor phase transport, Temperature-dependent photoluminescence