

INFLUENCE OF SUBSTRATE MORPHOLOGY ON ZnO NANOSTRUCTURES GROWN BY ELECTROPHORETIC DEPOSITION

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The potential of nanotechnology depends heavily on the ability to manipulate atoms and nanoparticles with the greatest versatility possible during the manufacturing process of nanostructures. The use of low dimensional structures is a key technological factor in the creation of new functional and sensing devices which benefit from their large surface area to volume ratio. Nevertheless, many properties of nanomaterials depend not only on their size but also on their growth processes. Therefore, it is imperative the quest for a proper understanding and control of the relation between growth processes, structure, morphology, and resulting properties.

Among the semiconductor materials, ZnO is considered important and promising. Reasons for this include low-cost, simple and controllable synthesis of a wide diversity of nanostructures, and the interesting potential applications in photonics, and chemical and biological sensing offered by them.

In a previous work [1], we reported the self-assembled growth (without a sacrificial template) of ZnO nanowires on Si substrate with Au nanoclusters. The nanowires growth was performed at room temperature by electrophoretic deposition (EPD) from a ZnO nanoparticles colloidal suspension.

Since experimental results show that the morphologies and qualities obtained are strongly dependent upon substrate morphology, in the current work we investigate the influence of size, shape and separation between Au nanoclusters on the properties of ZnO nanostructures grown by EPD.

The substrates used are commercial Si wafers and Si wafers with amorphous SiO₂ layers (grown by thermal oxidation), where a Au nanolayer is deposited by sputtering and annealed at different conditions to produce distinct morphological nanometer-sized Au clusters. The obtained ZnO nanostructures are characterized by scanning and transmission electron microscopy, energy-dispersive X-ray spectroscopy, X-ray diffraction and photoluminescence spectroscopy. The influence of the morphology of the substrate and process parameters on the quality and morphology of the nanostructures produced is discussed in detail.

[1] C. Sandoval, O. Marin, S. Real, D. Comedi, M. Tirado. Electrophoretic deposition of ZnO nanostructures: Au nanoclusters on Si substrates induce self-assembled nanowire growth. *Materials Science Engineering B*, 187, 21-25 (2014).