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Synthesis, structural properties and applications of zinc oxide nanowires growth on different substrates

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Statement of the Problem: Zinc oxide (ZnO) nanowires have been widely studied due to their use in many devices, such as UV lasers, light-emitting diodes, solar cells, nanogenerators, gas sensors, photodetectors, and photocatalysts to inactivate bacteria and for the degradation of environmental pollutants. ZnO NWs have been synthesized by wet chemical methods, sputtering, physical vapor deposition, pulsed laser deposition, metal–organic chemical vapor deposition (MOCVD) and molecular beam epitaxy (MBE). But, the relationship between the properties desired in applications and the preparation conditions is not clearly revealed. The purpose of this study is to evaluate the morphology and the physical properties of ZnO nanowires growth in different preparation conditions according to application requirements. Methodology: ZnO nanowires have been synthesized by hydrothermal method on a seed layer prepared by sol-gel process on different substrate materials (silicon oxide, indium-tin oxide, gold, graphene oxide, reduced graphene oxide) and in different conditions. The size of ZnO nanowires was evaluated using scanning electron microscopy. The morphology, structure and optical properties were investigated by X- ray diffraction, photoluminescence and UV-Vis spectra. The photorespons of ZnO nanowires growth on pre-patterned electrodes was evaluated from photocurrent measurement in different illumination conditions. Findings: The morphology and properties of ZnO nanowires can be easy and effectively controlled by a variety of parameters such as concentration and pH of solution, temperature and time of hydrothermal process. The choice of substrate may be another option to improve some applications based on ZnO nanowires. Conclusion & Significance: This study point out that ZnO nanowires grown on silicon oxide and indium-tin oxide are suitable for solar cells, those grown on gold are suitable for sensors and those grown on graphene oxide and reduced graphene oxide for UV photodetectors.

Biography

Dr. Paula Obreja has expertize in materials, processes and 3D microfabrication and manufacturing of optical components and photonic devices. She's main areas of interest are in the applied research for development of new materials with improved physical properties and innovative processes for thin films preparation. In its projects she developed polymer and hybride nanocomposite materials for MOEMS and sensors microstructures, synthesis of CuInSe2 and other semiconductor, sol-gel, self- assembly, soft lithography or microstructuring techniques for micro and nano-photonics, light-emitting diodes, IR diodes and photodetectors for optical communications.

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