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Metal-oxide Semiconducting Nanostructures by Microwave-assisted Thermal Oxidation Technique for Sensor and Solar Cell Applications

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Metal-oxide semiconducting (MOS) Nanostructures prepared by microwave assisted thermal oxidation technique are demonstrated. With this simple and fast process, MOS nanostructures with various morphologies can be synthesized such as ZnO tetrapods, interlinked ZnO tetrapod networks (ITN-ZnO), MgO nanoparticles, CuO/Cu2O fibers. Mostly, ITN-ZnO morphology which have tetrapod-like features with leg-to-leg linking is presented here. The electrical and ethanol-sensing properties related to the morphology of ITN-ZnO compared with those of other ZnO morphologies are investigated. It is found that ITN-ZnO unexpectedly exhibits superior electrical and gas-sensing properties in terms of providing pathways for electron transport to the electrode. A UV sensor and a room-temperature gas sensor with improved performance are achieved. Therefore, ITN-ZnO is an attractive morphology of ZnO that is applicable for many new applications because of its novel properties. The novel properties of ITN-ZnO are beneficial for electronic, photonic, optoelectronic, and sensing applications. ITN-ZnO may provide a means to improve the devices based on ITN-ZnO. Moreover, MgO nanoparticles and CuO/Cu2O fibers prepared by microwave assisted thermal oxidation technique are also demonstrated and applied for dye-sensitized solar cells.

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