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*Tuning of Metal Oxides Nanostructures under Soft Hydrothermal Conditions*

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Hydrothermal method of materials processing is becoming very popular in recent years, particularly for nanomaterials with tailor-made properties. It has several advantages owing to the controlled diffusion processes and soft temperature and pressure conditions. The in situ fabrication and surface modification provide an excellent possibility to obtain nanoparticles with desired shape, size, structure, and surface chemistry [1]. The experimental parameters like temperature, pressure, starting raw materials, solvent, dopants, surface modifiers, and pH control the phase purity, crystallinity, size, shape, surface chemistry and properties of nanoparticles. In the present work, the authors have chosen the metal oxide nanoparticles like TiO2, ZnO, BiVO4, and graphene oxide as the title compounds and studied in detail the tuning of size, structure, and properties such as physical, chemical and biological with respect to the hydrothermal process parameters. These metal oxides are the frontier materials in technology owing to their great application potential as photocatalysts, gas sensors, dye-sensitized solar cells, and so on [2]. Tuning of their morphology is very crucial for specific applications. Nanoflowers, nanorods, nanosheets, nanoplates, nanoprisms, nanospikes, etc have direct implications on their applications [3]. In this context, the solution processing methods are widely used to prepare such nanostructures. The role of every experimental parameter including the type of surfactant, temperature, experimental duration and the solvent is very important to understand the mechanism of formation of nanostructures of these metal oxides. Several growth mechanisms have been proposed to explain their formation especially in the presence or absence of additives, defects formation, surfactant and its concentration, and experimental temperature. Various stages of formation of these nanostructures have been explained with appropriate schematic diagrams and theoretical principles. The present authors have investigated systematically the heterogeneous growth mechanism of these metal oxide nanostructures. A systematic characterization of these nanostructures obtained has been carried out using powder XRD, XPS, FTIR, UV-Vis spectroscopy, FESEM, and TEM.

References

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