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Microwave power, temperature, atmospheric and light dependence of intrinsic defects in ZnO nanoparticles: A study of electron paramagnetic resonance (EPR) spectroscopy

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Highlights

- â€¢ Easy way of synthesizing ZnO nanomaterial.
- â€¢ Identification of defect centers and detailed analysis of coreâ€“shell model.
- â€¢ Investigating the reactivity of intrinsic defect centers under different conditions.

â€¢ Analyzing spectral changes by reducing the particles size (size effects).

Abstract

In this work ZnO nanoparticles were synthesized by coprecipitation method. We investigated the reactivity of 0.24Â Î¼m and 50Â nm ZnO sample as bulk and nano-sized, respectively. According to coreâ€“shell model we designated the electron paramagnetic resonance (EPR) signal at gÂ â‰ˆÂ 2.004 and gÂ â‰ˆÂ 1.961 as surface defects and core defects, respectively. Dependency of intrinsic defects on the surface and core were investigated under various conditions such as changing of microwave power and temperature, different atmosphere and different light exposures. We found that under such condition core defects revealed more controllable property than the surface defects. Spinâ€“lattice (T_1) and spinâ€“spin (T_2) relaxation time were also calculated from microwave power dependency measurements and it is found out that both relaxation time lays around nano-second regime which is extremely short. However relaxation time T_1 can be longer under N_2 atmosphere after further annealing.

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Keywords

ZnO; EPR spectroscopy; Defects; Size-effects

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