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Morphological, structural and optical properties of Mg-doped ZnO nanocrystals synthesized using polyol process(Article)

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In this work, the undoped and Mg (0.5–20.0 at.%) doped ZnO nanocrystals have been synthesized using the polyol process and their morphological, structural, optical properties as well as chemical composition have been investigated. X-ray diffraction, transmission and scanning electron microscopy, energy dispersive X-ray, Raman and UV-vis spectroscopies were used to identify effective incorporation of Mg atoms into ZnO lattice without the formation of secondary phases at Mg up to 5 at.%. At higher Mg doping level, Mg(OH)2 phase traces were evidenced. The results have revealed the reduction of sizes and worsening the crystal quality of ZnO nanocrystals with increase of Mg doping. ZnO nanocrystals lose spherical shape forming the rod-like and amorphous nanostructures at Mg ≥ 5 at.%. Raman spectra have confirmed E2 (high), E2 (low), E2 (high) - E2 (low), A1(TO) modes for undoped, and Eu(TO) mode for Mg-doped ZnO nanocrystals. The optical band gap has been found in the range of 3.40–3.80 eV.