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Effect of Pb doping and annealing temperature on the structural and optical properties ZnO nanoparticles synthesized by sol-gel method

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Abstract content
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Un-doped and Pb-doped ZnO nanoparticles were successfully synthesized in an ethanolic solution by using a sol-gel method. Structural and optical properties of the samples dependence on annealing temperatures and Pb concentrations were investigated while other parameters were kept constant to ensure reproducibility. It was observed that the structural properties, particle size, band gap, photoluminescence intensity and wavelength of maximum intensity were influenced by the amount of Pb ions present in the precursor and the annealing temperature. The XRD spectra for ZnO nanoparticles show the entire peaks corresponding to the various planes of wurtzite structure, indicating a monophasic material. The diffraction peaks of doped samples are slightly shifted to lower angles with an increase in the Pb ion concentration, signifying the expansion of the lattice constants and increase in the band gap of ZnO. All the samples show the absorption in the visible region. The absorbance spectra show that the excitonic absorption peak shifts slightly towards the lower wavelength side with the Pb-doped ZnO nanoparticles. The PL spectra of Pb-doped ZnO consist of UV emission at 340 nm and two broad visible emissions at 370 and 460 nm with varying relative peak intensities. The amount of Pb concentrations red shifts the 460 nm emission but other emissions are hardly affected. The doping of ZnO with Pb amount up 2 mol% enhances significantly the defects emission but quenches thereafter while UV luminescence is hardly affected. The SEM images also clearly show the change in shape and size of ZnO nano particles with increase in annealing temperature.

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