

Abstract

Elaboration and characterization of nanocrystalline zinc aluminates (pure and doped) produced by the Sol-gel method

Samples of pure zinc aluminates (ZnAl_2O_4) and doped ZnAl_2O_4 with both lead (Pb^{2+}) at different ratios (0, 0.5, 1, 1.5, 2, and 2.5% mol) and a constant amount of lanthanum (La^{3+} : 1% mol), were prepared by the citrate sol-gel technique, and then annealed at 900°C for 2h. To study the structural, optical, and thermal properties; different characterization methods were used, such as powder X-ray diffraction (XRD), scanning electron microscopy (SEM), energy-dispersive X-ray spectroscopy (EDX), differential scanning calorimetry (DSC-TG), Fourier transform infrared spectroscopy (FTIR) and Raman spectroscopy. Analysis by XRD revealed the presence, for all samples, of the cubic, single-phase ZnAl_2O_4 , without any impurity phases, with a crystallites size between 19 and 25 nm. These results were confirmed using FTIR and Raman spectroscopy. Also UV–VIS spectra indicated that the band-gap of the doped samples decreases and exhibits a red shift with the increase of Pb^{2+} ion concentration. In addition, a photocatalytic study for different samples of ZnAl_2O_4 showed that they could be used as photocatalysts and good adsorbents for the degradation of a Hexamethyl Crystallized Violet (HCV) dye in an aqueous solution. Photoluminescence spectra of pure, doped, and co-doped ZnAl_2O_4 show emission peaks located at 432, 510, and 566 nm

Keywords: ZnAl_2O_4 nanoparticles, Sol-gel, photocatalysis, Adsorption,