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Preparation and characterization of spinel type Zn2TiO4 nanocomposite.

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Abstract: Zinc orthotitanate Zn2TiO4 spinel structures have been prepared by solid state reaction in two stages. First, a mixture of ZnO and TiO2 (67% anatase+33% rutile) in a molar ratio of 2:1 was mechanically milled for 6 and 18 h, at room temperature, in a high energy planetary ball mill under argon atmosphere. Next, the ball milled powders were calcined at 900°C for 2 h, pressed into pellets and then sintered for 4 h at 1100°C in air. Phase formation, microstructure, surface morphology and optical properties were characterized by X-ray di?raction, Raman scattering spectroscopy, Fourier transform infrared spectroscopy (FT-IR), scanning electron microscopy coupled with energy dispersive X-ray spectroscopy, atomic force microscopy and UV–visible spectro-photometery. The mechanical milling process for 6 h gives rise to the formation of nanocrystalline orthotitanate Zn2TiO4 (15.5%, =13.2 nm) in addition to unreacted rutile TiO2, anatase TiO2 and ZnO structures. As the milling process progresses up to 18 h, the volume fraction of Zn2TiO4 increases to about 44.5%. The sintered pellets exhibit a composite structure where about a small amount of rutile nanograins are dispersed into the Zn2TiO4 matrix. FT-IR and Raman results con?rm the biphasic character of the sintered pellets. The band gap energy is milling time dependent. It varies from 3.22 for pellet 6 h to 3.45 for pellet 18 h.

Keywords : Mechanical Alloying, ZnO?TiO2 system, XRD, Raman spectroscopy, SEM