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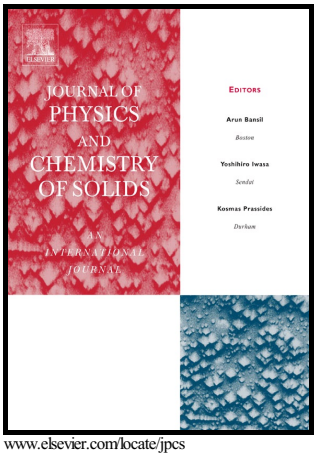

www.elsevier.com/locate/jpcs

PII: S0022-3697(16)30014-2
DOI: http://dx.doi.org/10.1016/j.jpcs.2016.01.014
Reference: PCS7713

To appear in: *Journal of Physical and Chemistry of Solids*

Received date: 10 November 2015
Accepted date: 18 January 2016

Cite this article as: Chandana Roy Chaudhury, Anirban Roychowdhury, Anusree Das and Dipankar Das, Magneto-optical properties of α-Fe_2O_3@ZnO nanocomposites prepared by the high energy ball-milling technique, *Journal of Physical and Chemistry of Solids,* http://dx.doi.org/10.1016/j.jpcs.2016.01.014

Magneto-optical properties of α-Fe_2O_3@ZnO nanocomposites prepared by the high energy ball-milling technique

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Abstracts

Magnetic-fluorescent nanocomposites (NCs) with 10 wt. % of α-Fe_2O_3 in ZnO have been prepared by the high energy ball-milling. The crystallite sizes of α-Fe_2O_3 and ZnO in the NCs are found to vary from 65 nm to 20 nm and 47 nm to 15 nm respectively as milling time is increased from 2 to 30 hr. XRD analysis confirms presence of α-Fe_2O_3 and ZnO in pure form in all the NCs. UV-vis study of the NCs shows a continuous blue shift of the absorption peak and a steady increase of band gap of ZnO with increasing milling duration that are assigned to decreasing particle size of ZnO in the NCs. Photoluminescence (PL) spectra of the NCs reveal three weak emission bands in the visible region at 421, 445 and 485 nm along with the strong near band edge emission at 391 nm. These weak emission bands are attributed to different defect- related energy levels e.g. Zn-vacancy, Zn interstitial and oxygen vacancy. Dc and ac magnetization measurements show presence of weakly interacting superparamagnetic (SPM) α-Fe_2O_3 particles in the NCs. ^{57}Fe-Mössbauer study confirms presence of SPM hematite in the sample milled for 30 hr. Positron annihilation lifetime measurements indicate presence of cation vacancies in ZnO nanostructures confirming results of PL studies.

Keywords: Nanocomposites; hematite; zinc oxide; Mössbauer spectroscopy; optical studies

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