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Sol-Gel Synthesis, Crystal Structure, Electronic and Magnetic Properties in $ZnFe_2O_4$ Spinel Oxide

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Abstract—*Synthesis of $ZnFe_2O_4$ spinel oxide was carried by sol-gel method via nitrate-citrate precursor route. The analysis of the powder XRD pattern of the sample by Treor90 software using fullprof shows cubic unit cell with lattice parameter a = 8.4402 Å. The unit cell volume for the sample is 601.27. The observed density value are found to be in the range 5.782 g/cc. Comparison of the observed density with the calculated one show that Z=8 for the samples and space group F4/d-3m. Average crystallite sizes determined by Scherrer's relation are found to be in the range = 43-78 nm. The morphology of the samples characterized by scanning electron microscopy (SEM) show fairly similar agglomerated microstructures. The particle size varies from nanometers to micrometers range. The differential thermal analysis (DTA) and thermo gravimetric analysis (TGA) traces showfor the material $ZnFe_2O_4$ the slight weight loss ~1.3 % over the range upto ~ 500 ºC which corresponds to physically and chemically adsorbed water. There is no significant phase transition in the sample in the range 300-1000 ºC showing the high thermal stability of the sample.*

The experimental optical absorption spectra of $ZnFe_2O_4$ shows the only weak peak ~ 500 nm (20000 cm^{-1}) corresponds to $^6A_g \rightarrow E_g$ transition in Fe^{3+} ($3d^5$) in octahedral field. The Electron Paramagnetic Resonance (EPR) studies carried out at low (5 K and 94 K) temperatures and 300 K shows the g-values of $ZnFe_2O_4$ spinel oxide. The observable g-values at 300 K are 2.753, 2.283 and 1.709 corresponding to the Fe^{3+} in different octahedral [$FeO_{6/2}$] environments which are smeared out at 94 K and 5 K.Magnetic studies shows Formation of hysteresis loop in the cyclic range clearly indicates the week ferromagnetic nature of $ZnFe_2O_4$ spinel at 300 K.