Preparation of Fe₃O₄-ZnO core - shell nanopowders and comparison of their magnetic and optical Properties

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Abstract: In this study, at first the magnetite (Fe₃O₄) nano particles were prepared by sol-gel method under inert atmosphere using ferric nitrate (Fe(NO₃)₃.9H₂O) and ethylene glycol (C₂H₆O₂) as precursors. In the next stage, magnetite nanoparticles were modified by Sodium citrate under Ar atmosphere. Also zinc oxaid (ZnO) nanoparticles were provided via co-precipitation route and heat treatment using ammonium carbonate and zinc acetate as precursors. The precursor was dried and then calcined at 350°C. Finally with the ZnO and modified Fe₃O₄ nanoparticles, core–shell system was produced. X-ray diffraction pattern (XRD) considered structure characteristic and the size of crystallites. Morphology and the average size of particles were determined by SEM and TEM electron microscope. The UV absorption spectra show that absorption wavelength value for Fe₃O₄/ZnO core-shell is increased in comparison with ZnO pure nanoparticles. FT-IR Spectra indicated the characteristic absorption of Zn–O bond is at 443/81 cm⁻¹ and Fe–O bond is at 540/20 m⁻¹. Variation of magnetization of samples with respect to the external field was investigated by Vibrating Sample Magnetometer (VSM). Investigation shows that Fe₃O₄ nanoparticles are super paramagnetic but Fe₃O₄/ZnO core-shell nanopowders are ferromagnetic. On the other hand, in core-shell system, the amount of remanence or coercivity field have not had a considerable changes with increasing in molar ratio of ZnO to magnetite.

Keywords: Magnetite; Zinc oxide; Core – shell; Nanoparticle; Sol-gel.

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