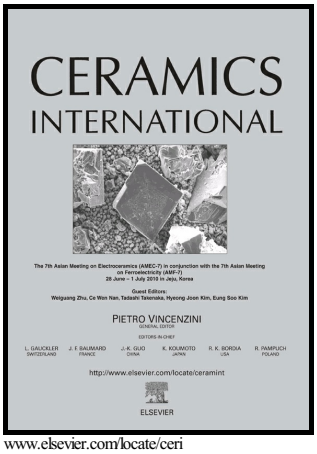

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Effect of Zn substitution on the structural and magnetic properties of nanocrystalline $NiFe_2O_4$ ferrites

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Abstract

Nanocrystalline $Ni_{1-x}Zn_xFe_2O_4$ (where, x = 0.0, 0.2, 0.4, 0.6, 0.8 & 1) samples were synthesized through solution combustion technique using oxylyl de-hydrazide (ODH) as a fuel and the effect of dopant and its concentration on the structural and magnetic properties was investigated. As-prepared samples were characterized using different characterization techniques such as, XRD, SEM-EDS, TEM and Raman spectroscopy for their phase-purity, crystallinity, surface morphology and elemental composition; also magnetic properties were investigated through EPR, Mossbauer spectroscopy and vibrating sample magnetometer (VSM). Rietveld fitted XRD and Raman studies confirm the formation of cubic spinel structured ferrites and substitution of Zn ion at Ni site without formation of impurity phases. No other structural changes were observed and the structure remains in cubic phase with increase of Zn concentration. SEM and TEM micrographs reveal that the particles are agglomerated and the particles size were found in the nano range. Also good stoichiometric composition was observed in all the compositions of Zn substituted Ni ferrite samples. Magnetic measurements (VSM) reveal thatpure Ni ferrites exhibits soft magnetic behaviour. Further the ferromagnetic behaviour suppressed with the substitution of diamagnetic Zn ion and with increase of its concentration in Ni ferrites, which was further evidenced in the Mossbauer spectroscopic results. At room temperature, electronic paramagnetic resonance spectra exhibits a broad resonance signal with Lande's g factor varies from 2.23 to 1.95 with increase in Zn content, which is attributed to spin exchange interactions between Fe^{3+}, Ni^{2+} and Zn^{2+} ions