

Structure and non-linear optical properties of Cu/Al substituted magnesium ferrite nano powders

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We report the influence of $\text{Cu}^{2+}/\text{Al}^{3+}$ substitution in ferrite nano particles and the magnetic properties of the nano particles have basic composition $\text{Cu}_x\text{Mg}_{1-x}(\text{Al}_x\text{Fe}_{2-x})\text{O}_4$ ($0.0 \leq x \leq 1.0$) which is synthesized by solid-state reaction route method. X-ray diffraction (XRD), transmission electron microscopy (TEM), Fourier transformation infrared (FTIR) spectroscopy techniques are used to investigate the structural properties of the synthesized nano particles (NPs). Fig.1 shows the XRD spectrum of $\text{Cu}_x\text{Mg}_{1-x}(\text{Al}_x\text{Fe}_{2-x})\text{O}_4$ ($0.0 \leq x \leq 1.0$). XRD results are confirming that all the samples are single-phase cubic in structure. The unit cell parameter "a" are calculated as from 8.675 to 8.10 Å respectively with variation of composition from $x=0.00$ to 1.00. The average crystallite size of the synthesized NPs was calculated through Scherrer formula and confirmed by TEM and was found to be less than 10 nm. TEM images are also shown in Fig.2. FTIR spectrum shown in Fig.3 indicate the presence of two vibrational bands corresponding to tetrahedral and octahedral sites. Nonlinear optical properties of the samples studied using 5 ns laser pulses at 532 nm employing the open aperture z-scan technique indicate that these ferrites are potential candidates for optical limiting applications.

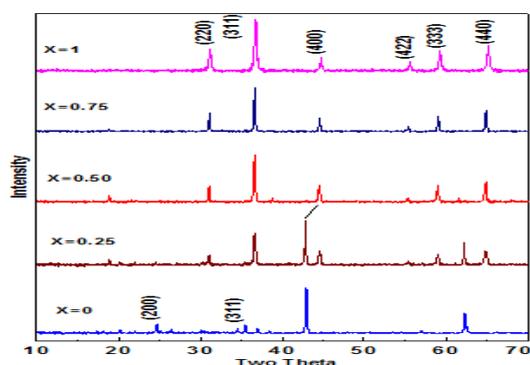


Fig.1 XRD spectrum of $\text{Cu}_x\text{Mg}_{1-x}(\text{Al}_x\text{Fe}_{2-x})\text{O}_4$

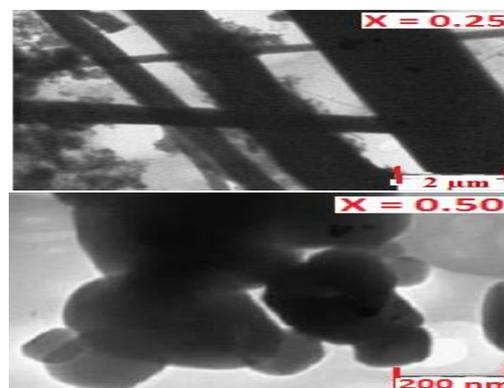


Fig.2 TEM images of $\text{Cu}_x\text{Mg}_{1-x}(\text{Al}_x\text{Fe}_{2-x})\text{O}_4$

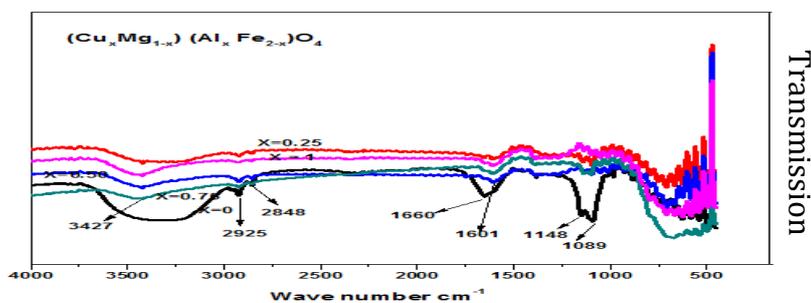


Fig.3 IR spectrum of $\text{Cu}_x\text{Mg}_{1-x}(\text{Al}_x\text{Fe}_{2-x})\text{O}_4$