

## Synthesize and Investigation of Magnetic and Structural Properties of $\text{MnFe}_2\text{O}_4$ Nanoparticles Substituted by $\text{Co}^{2+}$

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**Abstract:** In this research  $\text{Co}_x\text{Mn}_{1-x}\text{Fe}_2\text{O}_4$  nano particles ( $0 \leq x \leq 0.7$ ), using high purity metal nitrates and citric acid have been prepared by sol gel auto combustion method. The obtained powders were characterized by XRD, FT – IR, SEM and VSM analysis. The XRD patterns showed that the formed crystallites were all in the cubic single phase and the formed crystallite belongs to the space group Fd3m and average particle size was 20 nm. It is observed that for  $x \leq 0.5$ , ions  $\text{Co}^{2+}$  substituted into  $\text{MnFe}_2\text{O}_4$  tends to increase the lattice parameter and for  $x = 0.7$ , tends to reduce the lattice parameter. FT - IR spectra showed that the metal - oxide vibration band  $570 \text{ cm}^{-1}$  assigned the band to the tetrahedral group that corroborated the spinel structure. By the SEM micrographs of the Co - Mn ferrite samples studied, and it can be seen that particles of samples are spherical in shape with the average grain size varies between 50 nm and 80 nm. Hysteresis loops of the samples were obtained by Vibration Sample Magnetometer (VSM) demonstrated an initial increase in the saturation magnetization for  $x \leq 0.5$ , then decreases for  $x = 0.7$  caused to the difference in the contributions from the magnetic moments of the substituted ions on tetrahedral sites and octahedral sites in the spinel ferrite.

**Keywords:** Nanoparticles; Co - Mn Ferrite; Magnetic Properties.

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