

# Investigation of Structural and Magnetic Properties of Rare Earth Doped Co-Ferrite Nanoparticles Using X-Ray Powder Diffraction, Mössbauer Effect Spectroscopy and Neutron Diffraction Measurements

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Cobalt ferrite is one of the hard magnetic inverse spinel ferrite materials. Altering the chemical composition, and accordingly the physical properties, can be achieved by doping with different transition metals and rare earth (R) ions. The type of the dopant, its amount, and the preparation method strongly affect the cation distribution, particle sizes, particle size distribution, morphology.  $\text{CoFe}_{2-x}\text{Ce}_x\text{O}_4$  ( $x = 0.0 \leq 0.1$ ) nano ferrites were prepared using the citrate auto-combustion method. The structural parameters were studied using X-ray powder diffraction and neutron diffraction measurements. The Mössbauer effect spectroscopy suggested that all the studied samples are magnetically ordered. In addition, the signatures of increasing superparamagnetic contribution by decreasing the particle size (D) were observed. The cation distribution obtained from the Mössbauer effect spectroscopy illustrated a partial inverse spinel structure, which was also supported by the neutron diffraction measurements.