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Cation distribution of Ni^{2+} and Mg^{2+} ions improve structure and Magnetic Properties of Spinel Ferrites

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Abstract— *In the present work, ferromagnetic Ni is slightly substituted for diamagnetic Mg spinal ferrites. The effect of Ni doping on the structural and magnetic properties of ferrites material in the form of $Ni_xMg_{1-x}Fe_2O_4$ (x = 0.1,0.15,0.2,0.25, .0.3,0.35) has been the study. The Sol-gel auto Combustion method used to combine these substances uses urea as fuel. Sintered samples were shown using X-ray diffraction, Fourier Transform Infrared spectroscopy (FTIR) and a vibrating magnetometer sample. X-ray diffraction revealed that all the composite samples were pure cubic spinel arrays with a Fd3m space band and a permanent lattice that varied with Ni concentrations. the distribution of Ni^{2+} ions and Mg^{2+} ions in spinel ferrites indicates various changes in parameters such as tetrahedral ionic radius (r_A), octahedral ionic radius (r_B), hopping length (L_A and L_B). Fourier Transform Infrared (FT-IR) simulations showed wire vibration at the tetrahedral site and Octahedral site. spinel ferrites M-H curves are recorded at room temperature indicating normal hysteresis loop indicating the magnetic field.*

Keywords— ***Cation distribution, Magnetic Properties, Spinel Ferrites, nanobiotechnology, X-ray diffraction.***

I. INTRODUCTION

In recent years, a combination of magnetic nanomaterials has been investigated for use in a wide range of applications from radio frequencies to microwave frequencies [1,2].

Over the past decade, nanobiotechnology has attracted a lot of attention because of its therapeutic potential in various biomedical systems. The therapeutic potential of nanoparticles in biomedical applications is due to their unique physical and chemical properties such as nanometer size, large area to volume ratio, high bioavailability, interaction in cell space and cell membranes. Spinel ferrites are often exploited as technology; Their biomedical systems have attracted a lot of attention recently [3]. Physical, Chemical and Optical structures can be modified by magnetic doping (Co^{2+}, Mn^{2+}, etc.), zero-magnetic (Zn^{2+}, Cd^{2+}, etc.) and paramagnetic (Mg^{2+}, Al^{2+}, etc.) cations on spinel ceramic ferrites, more importantly introducing the concept of flexible magnetic structures. Changes in Property are due to the distribution of divalent and trivalent cations between the available tetrahedral (A) and octahedral (B) so-called exchange interactions [4,5]. Common formulas of spinel ferrites MFe_2O_4. where M is usually a transition metal or a combination of switching metals with the Fd3m space group. The strongest interaction between cation is the interaction between cation at sites A and B, so-called A-B connections, where the angle of the cation-anion-cation bond is 180 degrees. The second strongest interaction between cations at B sites, called B-B interactions [6].

In the current context, the interaction between $Ni^{2+}$and Mg^{2+} cations at octahedral and tetrahedral sites alter features such as magnetic, physical, and structural