EP-02. Intrinsic and induced magnetic anisotropies in NiZn and NiZnCo spinel ferrites: a determination of their respective contributions by using either microwave (FMR) or static (Single Point Detection) measuring methods. J. Mattel, A. Mauloué, V. Lauer and A. Chevalier. 1. Functional Materials, Lab-STICC, Brest, France


EP-06. Effect of Zn doping on the magnetic and dielectric properties of nanocrystalline GaFeO₃. T. Han, C. Yen, Y. Chung and Y. Lee. 1. Department of Applied Physics, National University of Kaohsiung, Kaohsiung, Taiwan


EP-08. Time evolution of magnetic properties of MgFeO₃: role of cation distribution. S. Raghuvanshi, F. Mazaleyrat, A. Pasko and S. Kane. 1. School of Physics, Devi Ahilya University, Indore, India; 2. SATIE, ENS Cachan, CNRS, Université Paris-Saclay, Cachan, France


I. INTRODUCTION Nanosized ferrite particles have been largely studied due to their different magnetic properties compared to their bulk [1]. Among these ferrites, magnetite Fe₃O₄ has attracted the most attention due to its unique magnetic and thermal properties for biomedical application [2]. To improve the magnetic properties of the nanoparticles, Fe₃O₄ nanoparticles doped with Zn, represented as Fe₃₋ₓZnₓO₄ (x≤0.1). The magnetic properties of Zn ferrite reported to be related to the cation distribution [3]. It has been demonstrated that iron oxide nanoparticles of Zn-substituted can inverse the net magnetic moment of the resulting mixed spinel structure. Also, compared with other ferrite materials, Zn ferrite has been reported to reduce toxicity [3]. In this study, we synthesized Zn-doped Fe₃O₄ nanoparticles and characterized the nanostructure, magnetic and thermal properties for biomedical applications.

II. EXPERIMENT PROCEDURES The Fe₃₋ₓZnₓO₄ samples were prepared by the high temperature thermal decomposition method. Starting materials were Fe(III) acetylacetonate, Zn(II) acetylacetonate, oleic acid, oleylamine, and benzyl ether. The reaction mixture was heated to 200°C and was reheated at 300°C for 1 h. The mixture was lowered to 200°C and maintained it at that temperature for 1 h due to disperse the particles and to obtain uniform distributions in the particles sizes and shapes. Later, the solution was cooled to room temperature and obtained black nanoparticles were washed with ethanol and hexane. The crystal structure of the samples was examined by XRD. Its magnetic properties were investigated by VSM measurement. Thermal measurements were performed with Magnetherm device under an applied magnetic field of 250 Oe at frequency of 112 kHz. The argon plasma equipment was used non-thermal method and applied of 100 V. And the Mössbauer spectra were recorded in the constant mode with a ⁵⁷Co γ-ray source in a rhodium matrix.

III. RESULTS AND DISCUSSION From the result of XRD measurement, the crystal structure of Zn doped Fe₃₋ₓZnₓO₄ (x≤0.1) samples are determined to be cubic spinel with space group Fd₃m. The lattice constant a₀ increases with the Zn contents, since the ionic radius of Zn²⁺ is larger than that of Fe²⁺ and Fe³⁺. The experimentally measured saturation magnetization (Mₛ) of the samples extracted from the hysteresis loops are shown in Fig. 1. We observed that Mₛ value at 295 K increase with x up to x = 0.05 and then decrease as x increase above 1.0. These result is the doping effect on the ion occupation status in tetrahedral A- and octahedral B-site due to the exchange interactions in magnetite. Fig 2 shows the self-heating temperature under magnetic applied field of 250 Oe at 112 kHz. The self-heating temperature of the nanoparticles for x = 0.05 was highest among the samples. We exposed the x = 0.05 nanoparticles to an argon-plasma for 30 min. As a result, the Mₛ and the self-heating temperature value increased. From these results, we have observed the Mössbauer spectra of the before and after plasma treatment at various temperatures ranging from 4.2 to 295 K. The Mössbauer spectra were analyzed considering the cation distribution. After plasma treatment, the value of the hyperfine fields (Hhf) for the A- and the B-sites was increased. We conclude that the plasma treatment enhances of the Mₛ, self-heating temperature, and Hhf, which is expected from the conversion of the internal magnetic energy to thermal energy.