Editor’s Note

The Ferrite term is used to refer to all magnetic oxides containing iron as major metallic component. Ferrites are very attractive materials because they simultaneously show high resistivity and high saturation magnetization, and attract now considerable attention, because of the interesting physics involved. Typical ferrite material possesses excellent chemical stability, high corrosion resistivity, magneto-crystalline anisotropy, magneto-striction, and magneto-optical properties. Ferrites belong to the group of ferrimagnetic oxides, and include rare-earth garnets and ortho–ferrites. Several new hard and soft ferrites, garnets and their composite systems have been developed during recent years, with very large potential applications, which include bio-sensors, targeted drug delivery, magnetic imaging pigments, anti radar coating, microwave components, transparent magnetic plastics, etc. From physical point of view, ferrites present an extremely interesting class of systems with challenging problems. Besides scientific interest in their physical, magnetic, dielectric properties, ferrites have potential application for EMI shielding. Hence this special volume is prepared under Trans Tech Publishers agreement to focus on some of these topics of interest to university researchers and entrepreneurs in industry.

This volume consists of ten Chapters, including review and research papers. Chapter 1 “A Review on Ba₆Sr₁₋ₓFe₁₂O₁₉ Hexagonal Ferrites for use in Electronic Devices” by F. M. M. Pereira and A. S. B. Sombra sets the tone for this volume. There has been great interest in the M-Type hexaferrites for applications as electronic components for mobile and wireless communications at microwave/GHz frequencies, electromagnetic wave absorbers for electromagnetic compatibility (EMC), radar absorbing material and stealth technologies, and as composite materials. This review is focused on the study of the structure, magnetic and dielectric properties of the hexaferrite, Ba₆Sr₁₋ₓFe₁₂O₁₉, which is a promising material for electronic devices and for small dielectric resonator antennas (MRA). The authors have discussed in detail all the techniques used for synthesis of M-Type hexaferrites and their applications.

Second chapter “Yttrium Iron Garnet: Properties and Applications Review” is contributed by Mallmann et al. from Brazil. The authors have chosen the study of garnets as these have smaller dielectric losses and, therefore, find many applications. Their work presents the study of the ferrimagnetic composite, constituted by Y₃Fe₅O₁₂ (YIG) and Gd₃Fe₅O₁₂ (GdIG) phases, through solid state synthetic route and submitted to high-energy mechanical milling. Additionally, experiments were carried out in order to evaluate the electric and magnetic behavior of the composites at radio frequency and microwave range. The composites were found to be efficient as ferrite resonator antennas (FRAs) in the microwave frequency range. The composite resonators studied in this work can be important to the development of a third generation (3G) wideband antennas to cell phones and other wireless products.

The next two chapters are contributed by group of Silvia E. Jacobo from Argentina. The authors discuss “Preparation and Characterization of Nanocomposites for Technological Applications” in chapter 3, and “Coercivity Enhancement of Hexagonal Ferrites” in chapter 4. They have prepared through a new chemical method a PANI/Fe₃O₄ composite with different amounts of magnetic oxide. The final product is a powder with good solubility in some organic solvents as chloroform. The authors have explored these composites for application as absorbers in the microwave region and an interesting magnetoresistance (MR) behavior was observed. In chapter 4, the authors observed that samples with
lower iron content show the highest saturation magnetization, remanence and/or coercivity. Nd substitution enhances the ferrite anisotropy and coercivity with respect to the unsubstituted sample.

Chapter 5 “Modeling the Hysteretic Behavior of Textured and Random Ferroelectric Ceramics” is contributed by Zakharov et al. The authors have developed an algorithm for fast evaluation of the hysteresis loops of uniaxial or “textured” ferroelectric microcrystal or “grains” with long-range interactions. The qualitative analysis of the hysteretic behavior in terms of the grain distribution function is successfully demonstrated. This is the only theory paper in this volume.

Richa Desai et al. describe “Influence of Swift Heavy Ion (Si^{+8}) Irradiation on Super-paramagnetic Mn_{0.5}Zn_{0.5}Fe_{2}O_{4} Nanoparticles having Different Sizes” in chapter 6. The authors have used 100 MeV Si^{+8} ions to a fluence $5 \times 10^{13}$ ions/cm$^2$ for irradiation using the 15UD Tandem accelerator facility at IUAC, New Delhi. The magnetization measurement carried out at 300 K indicates that all the particles are super-paramagnetic at room temperature, but the applied magnetic field of 70 kOe is insufficient to saturate the system. In chapter 7, Jani et al. have reported effect of anisotropy on magnetic ordering in the spinel system. They have shown that the features observed in all their measurements are adequately explained using domain wall dynamics and inherent magneto-crystalline anisotropy without invoking the concept of cluster spin-glass type ordering.

Chapters 8 and 9 are contributed by Sonal Singhal group. The authors studied the efficiency of CuFe$_2$O$_4$ in catalyzing p-nitrophenol reduction to p-aminophenol. FT-IR and UV-Visible spectroscopy has been used to confirm this reduction process. In chapter 9, authors have studied the effect of chromium substitution on the structural, magnetic and dielectric properties of cobalt-zinc-copper ferrite. Nital and Rajshree studied “Effect of heat treatment on microstructure and magnetic properties of Strontium Hexaferrite Nanoparticles prepared in presence of non-ionic surfactant.” The authors observed that heat treatment conditions play significant role in the formation of pure SrFe$_{12}$O$_{19}$ hexaferrite phase, and also show an increase in the crystallite size of hexaferrite particles sintered at 1100 ºC.

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