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BOOK OF ABSTRACTS

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Session F10
SOFT MAGNETIC MATERIALS AND MAGNETIC SHIELDING I
(Poster Session)

Jean Anne Incorvia, Chair
University of Texas at Austin, Austin, TX, United States

F10-01. **Preparation and electro-magnetic properties of soft magnetic composites with ferrite nanofibres.** *J. Fuzer*[1], M. Streckova[2], S. Dobak[1], L. Dakova[1], P. Kollar[1], M. Faberova[2], R. Bures[2], Y. Osadchuk[1], P. Kurek[2] and M. Vojtko[2] *1. Institute of Physics, Faculty of Science, P. J. Šafárik University, Kosice, Slovakia; 2. Institute of Materials Research, Slovak Academy of Sciences, Kosice, Slovakia*

F10-02. **Spin-phonon Coupling in $BaFe_{12}O_{19}$ Synthesized Through the Proteic Sol–gel Process.** *M.P. Buzinaro*[2,1], N.D. Ferreira[2], J.M. Santos[2], F. Cunha[2], M.A. Macedo[2], G.C. Cunha[3] and P.H. Buzinaro[4] *1. COELT, Federal Institute of Education, Science and Technology of Sergipe, Aracaju, Brazil; 2. Physics, Federal University of Sergipe, Sao Cristovao, Brazil; 3. Chemistry, Federal University of Sergipe, São Cristovão, Brazil; 4. Mechanical Engineering, Faculty of Industrial Engineering of São Bernardo do Campo, São Bernardo do Campo, Brazil*

F10-03. **Magnetic properties of Y-type hexaferrite $Ba_xSr_{2-x}Ni_2Fe_{12}O_{22}$ (x = 0, 1.5) by using Mössbauer spectroscopy.** *J. Kim*[1], J. Lim[1] and C. Kim[1] *1. Department of physics, Kookmin University, Seoul, The Republic of Korea*

F10-04. **Development of Soft Z-Type Hexa Nanoferrites for Antenna Miniaturization up to S-Band.** *A.K. Manhas*[1] and M. Singh[1] *1. Department of Physics, Himachal Pradesh University, Shimla 171005, Shimla, India*

F10-05. **The Effect of the Sintering Temperature on the RF Complex Permeability of NiCuCoZn Ferrites for Near Field Communication (NFC) Applications.** *P. Lathiya*[1] and J. Wang[1] *1. Electrical Engineering, University Of South Florida, Tampa, FL, United States*

F10-06. **Magnetic properties of FeSi/ hybrid resin based composite with different $Ni_{0.3}Zn_{0.7}Fe_2O_4$ ferrite content.** *L. Dakova*[1], J. Fuzer[1], P. Kollar[1], Y. Osadchuk[1], M. Streckova[2], M. Faberova[2], R. Bures[2], P. Kurek[2] and M. Vojtko[2] *1. Department of Condensed Matter Physics, P.J. Safarik University, Kosice, Slovakia; 2. Institute of Materials Research, Kosice, Slovakia*

F10-07. **Modulation of magnetic properties in Ni-Zn ferrites by additives.** K. Mun[1] and *Y. Kang*[1] *1. Department of Materials Science and Engineering, Korea National University of Transportation, Chungju, The Republic of Korea*

F10-08. **Correlation of Hyperfine Field Distribution and Isomer Shifts with Magnetoelectric Properties in Mo-substituted Barium Hexaferrites.** *M. Przybylski*[1,4], J. Zukrowski[1], K. Latka[2], Z. Su[3], C. Yu[3], Z. Celinski[5], Y. Chen[6], A.S. Sokolov[7] and V.G. Harris[3] *1. Academic Centre for Materials and Nanotechnology, AGH University of Science and Technology, Krakow, Poland; 2. Institute of Physics, Jagiellonian University, Krakow, Poland; 3. Electrical and Computer Engineering, Northeastern University, Boston, MA, United States; 4. Faculty of Physics and Applied Computer Science, AGH University of Science and Technology, Kraków, Poland; 5. Physics, University of Colorado at Colorado Springs, Colorado Springs, CO, United States; 6. Rogers Innovation Center, Burlington, MA, United States; 7. Electrical and Computer Engineering, Northeastern University, Arlington, MA, United States*

F10-09. **Investigation of mechanisms governing microwave absorption in Co-La substituted Ba-Sr hexagonal ferrite from 8.2 GHz to 12.4 GHz.** H. Kaur[2], *C. singh*[1], A. Marwaha[2], S. BindraNarang[3], R. Jotania[4], S. R. Mishra[5], Y. Bai[6], K. James Raju[7], D. Singh[8], M. Ghimire[5], P. Dhruv[4] and S. Sombra[5] *1. Electronics and Communication Engg., Lovely Professional University, Jalandhar, India; 2. ECE, SLIET Longowal, Sangrur, India; 3. Department of Electronics Technology, Guru Nanak Dev University, Amritsar, India; 4. Department of Physics, Gujarat University, Ahmedabad, India; 5. Department of Physics, University of Memphis, Memphis, TN, United States; 6. Institute of Advanced Materials and Technology, University of Science and Technology, Beijing, China; 7. School of Physics, Central University, Hyderabad, India; 8. ECE Department, Indian Institute of Technology, Roorkee, India*

F10-10. **Evaluation of microwave absorption mechanisms in Co-Hf doped Ba-Sr hexagonal ferrite.** *R. Joshi*[8], C. singh[1], S. Narang[2], R. Jotania[3], S. Mishra[4], Y. Bai[5], K. Raju[6], D. Singh[10], M. Ghimire[4], P. Dhruv[3], S. Sombra[9] and J. Singh[7] *1. Electronics and Communication Engg., Lovely Prfoessional University Jalandhar Punjab India, Jalandhar, India; 2. Department of Electronics Technology, Guru Nanak Dev University, Amritsar, India; 3. Department of Physics, Gujarat University, Ahmedabad, India; 4. Department of Physics, The University of Memphis, Memphis, TN, United States; 5. Institute of Advanced Materials and Technology, University of Science and Technology, Beijing, China; 6. School of Physics, Central University, Hyderabad, India; 7. Department of Electronics and Communication Engineering, Yadavindra college of Engineering, Talwandi Sabo, India; 8. Department of Electronics and Communication Engineering, Rayat Bahra Institute of Engineering and Nanotechnology, Hoshiarpur, India; 9. Physics Department, Federal University of Ceara, UFC, Brazil; 10. ECE Department, Indian Institute of Technology, Roorkee, India*

MONDAY EVENING, 16 JULY 2018 SAN FRANCISCO BALLROOM, 5:00 TO 6:30

Session F10
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F10-01. Preparation and electro-magnetic properties of soft magnetic composites with ferrite nanofibres. *J. Fuzer*[1], M. Streckova[2], S. Dobak[1], L. Dakova[1], P. Kollar[1], M. Faberova[2], R. Bures[2], Y. Osadchuk[1], P. Kurek[2] and M. Vojtko[2] *1. Institute of Physics, Faculty of Science, P. J. Šafárik University, Kosice, Slovakia; 2. Institute of Materials Research, Slovak Academy of Sciences, Kosice, Slovakia*

Soft magnetic composites (SMCs) are extensively developed as a viable alternative to the laminated steel materials in a range of new applications, such as transformers, inductors, sensors, fast switching solenoids and electrical motors [1]. We present an innovative method for manufacturing the soft magnetic composites that may pave the way for magnetic cores with improved electromagnetic properties. In this paper, soft magnetic composites based on FeSi powder coated with the hybrid organic-inorganic coating composed of boron phenol-formaldehyde resin and $Ni_{0.3}Zn_{0.7}Fe_2O_4$ ferrite fibres were fabricated to investigate the effects of ferrite nanofibres on the structural and electromagnetic properties. The needle-less electrospinning was used for preparation of $Ni_{0.3}Zn_{0.7}Fe_2O_4$ soft magnetic fibres in large scale. The hybrid coating was deposited on a surface of spherical FeSi powder and processed by PM technology for a bulk sample for mechanical, electrical and magnetic tests. A uniformity of hybrid organic-inorganic coating is reflected in a high value of the electrical resistivity. A low porosity and extraordinary high values of mechanical hardness and flexural strength were found in prepared soft magnetic composites. The superior mechanical properties are found in the sample FeSi/PFRB/0.49ferrite, which achieved the appropriate composition and homogenous distribution of insulation phase. The resin coating causes the enhanced frequency stability of real permeability component up to 1 MHz and the relaxation frequency is mainly affected by electrical resistivity. The sample FeSi/PFRB/0.49ferrite is endowed with the lowest power losses at all measured frequencies. Our results show that the electro-magnetic properties of soft magnetic composites can be enhanced by appropriate content of ferrite fibres in the boron phenol-formaldehyde resin and value of electrical resistivity is much higher than common last-year results obtained by combining of Fe or their alloys with Ni-Zn or Mn-Zn coating prepared via different ways. The results presented can be used for future materials design of soft magnetic composites.

[1] K. J. Sunday. M. Taheri, Metal Powder Report, 72 (2017) 425-429

F10-02. Spin-phonon Coupling in $BaFe_{12}O_{19}$ Synthesized Through the Proteic Sol–gel Process. *M.P. Buzinaro*[2,1], N.d. Ferreira[2], J.M. Santos[2], F. Cunha[2], M.A. Macedo[2], G.C. Cunha[3] and P.H. Buzinaro[4] *1. COELT, Federal Institute of Education, Science and Technology of Sergipe, Aracaju, Brazil; 2. Physics, Federal University of Sergipe, Sao Cristovao, Brazil; 3. Chemistry, Federal University of Sergipe, São Cristovão, Brazil; 4. Mechanical Engineering, Faculty of Industrial Engineering of São Bernardo do Campo, São Bernardo do Campo, Brazil*

For decades, studies and research in relation to the magnetic behavior of phenomena is increasing considerably. One of the main challenges in the academic field is to develop magnetic materials with high magnetic saturation, relatively large magnetic anisotropy, high temperature Curie and high corrosion resistance. From these requirements, the hexagonal ferrites M-type $BaFe_{12}O_{19}$, also called BaM, gather interests that are increasing since they are expected to solve such problems. Thus, they can be applied in different materials, such as: permanent magnets, recording media, telecommunication, and as components in microwave, higher-frequency, and magneto-optical devices. With the objective of obtaining a lower cost to produce hexaferrite, since the syntheses of the material usually use reagents of high cost and harmful to the environment, this work proposes the synthesis of said material through the proteic sol–gel process, in which it uses the coconut water for dilution of precursor materials. Studies related to spin-phonon coupling have been performed for several magnetic materials, however there are few reports related to M-type hexaferrite barium. In this work we investigated the spin-phonon transition of the M-type hexaferrite of Ba through Raman spectrometry varying the temperature from the environment to 750 K, thus verifying changes in the position and intensity of the vibratory modes with the increase of temperature, from these changes was it is possible to detect the spin-phonon coupling in the study material. It is also shown, X-ray diffraction and Rieltveld refinement, indicating the formation of the single phase of the material being studied.

F10-03. Magnetic properties of Y-type hexaferrite $Ba_xSr_{2-x}Ni_2Fe_{12}O_{22}$ (x = 0, 1.5) by using Mössbauer spectroscopy. *J. Kim*[1], J. Lim[1] and C. Kim[1] *1. Department of physics, Kookmin University, Seoul, The Republic of Korea*

We studied the polycrystalline $Ba_xSr_{1-x}Ni_2Fe_{12}O_{22}$ (x = 0, 1.5) sample of Y-type hexaferrite prepared by using polymerizable complex method. The samples were investigated the crystal structure by X-ray diffraction (XRD) and magnetic properties by vibrating sample magnetometer (VSM) at various temperature ranging between 4.2 and 750 K, and Mössbauer spectroscopy at various temperature ranging between 4.2 and 300 K. Also, the dielectric properties of samples were investigated by network analyzer (NA). We analyzed by Rietveld refinement method and confirmed to be $Ba_xSr_{1-x}Ni_2Fe_{12}O_{22}$ (x = 0, 1.5) single phases of the hexagonal structure with space group *R-3m*. The lattice constants (a_0, c_0) of sample were a_0 = 5.84, c_0 = 43.38 Å (x = 0), and a_0 = 5.83, c_0 = 43.25 Å (x = 1.5), respectively. From the temperature dependence of the Zero-field-cooled (ZFC) magnetization curves under 100 Oe between 4.2 and 300 K, the spin transition temperature (T_S) of sample were found to be T_S = 47 K (x = 0), T_S = 188 K (x = 1.5). The magnetic hysteresis curve of the sample was measured by applying a magnetic field of up to 15 kOe at various temperatures and was not saturated at x = 1.5. At 295 K, the saturation magnetization (M_s) and coercivity (H_c) were found to be M_s = 21.94 emu/g, H_c = 115.77 Oe (x = 0), M_s = 20.03 emu/g, H_c = 83.74 Oe (x = 1.5). Mössbauer spectra were analyzed 6 different interstitial sub-lattices, which are $3b_{VI}$, $6c_{IV}^*$, $6c_{VI}$, $18h_{VI}$, $6c_{IV}$, $3a_{VI}$. $3b_{VI}$ site was considered to have a hyperfine field (H_{hf}) greater than $18h_{VI}$ site due to the Ni ions. Also, the measured isomer shifts (δ) of all sample indicates that the Fe ions are the same as the Fe^{3+}. The network analyzer was used to measure the permeability (μ) and permittivity (ε) of samples from 50 MHz to 4 GHz. The permeability in the region of 800 MHz is μ = 4.0 (x = 0)

H. Yujih, et al, Journal of Applied Physics, 110, 033920 (2011).