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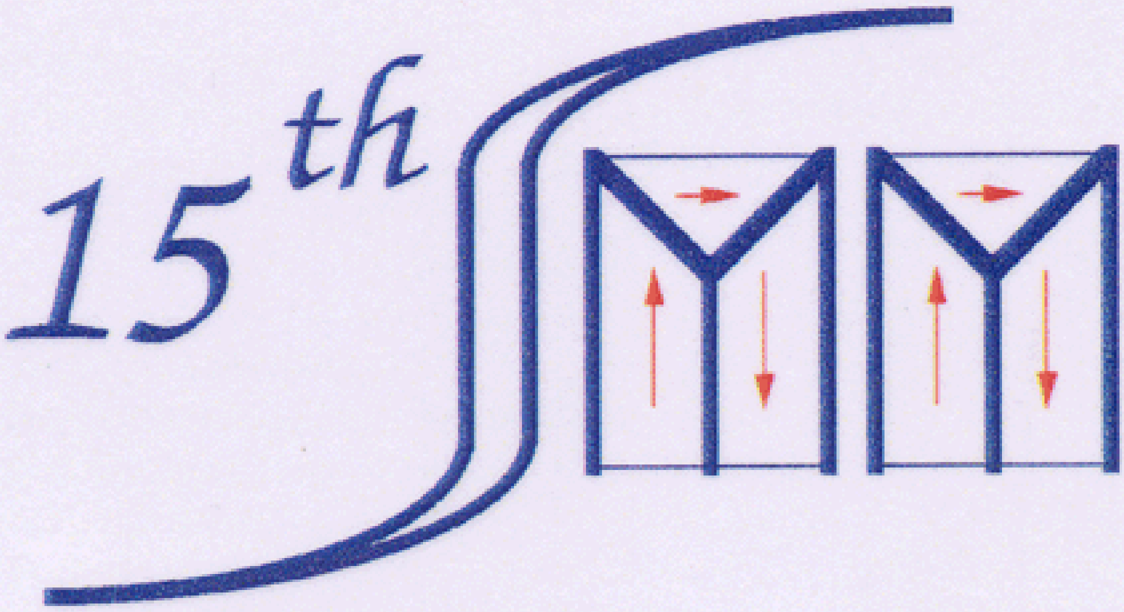

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BOOK OF ABSTRACTS

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ATOMIC MIGRATION IN $Co_{0.9}Zn_{0.1}Fe_2O_4$

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Ultrafine $Co_{0.9}Zn_{0.1}Fe_2O_4$ powders were prepared by a sol-gel method. Magnetic and structural properties of powders were characterized with a Mössbauer spectroscopy, vibrating sample magnetometry (VSM) and x-ray diffractometry. The crystal structure is found to be a cubic spinel with the lattice constant a_0=8.392 ± 0.005 Å. Mössbauer spectra of $Co_{0.9}Zn_{0.1}Fe_2O_4$ measured at various absorber temperatures of 20 to 830 K. Its Néel temperature T_N is found to be 790 K. The Mössbauer spectra consist of two six-line patterns corresponding to Fe^{3+} at the tetrahedral (*A*) and octahedral (*B*) sites. Plots of reduced magnetic hyperfine field $H_{hf}(T)/H_{hf}(0)$ against reduced temperature T/T_N for *A* and *B* sites of $Co_{0.9}Zn_{0.1}Fe_2O_4$ optimize the Brillouin curve *B(S)* for S=5/2. It is found that Debye temperature for the *A* and *B* sites of $Co_{0.9}Zn_{0.1}Fe_2O_4$ is found to be $\Theta_A = 756 \pm 5$ K and $\Theta_B = 199 \pm 5$ K, respectively. The intensity ratio of the *A* to *B* patterns is found to increase at low temperatures with increasing temperature due to the large difference of Debye temperatures of the two sites and to decrease at high temperatures due to migration of Fe^{3+} ions from *A* to *B* sites. Atomic migration of $Co_{0.9}Zn_{0.1}Fe_2O_4$ starts near 295 K and increases rapidly with increasing temperature to such a degree that 78 % of the ferric ions at the *A* sites have moved over to the *B* sites by 700 K. The temperature dependence of both the magnetic hyperfine field and magnetization of $Co_{0.9}Zn_{0.1}Fe_2O_4$ is explained by the Néel theory of ferrimagnetism using three superexchange integrals: $J_{A\text{-}B} = -21.3$, $J_{A\text{-}A} = -12.5$, and $J_{B\text{-}B} = 5.2\ k_B$.