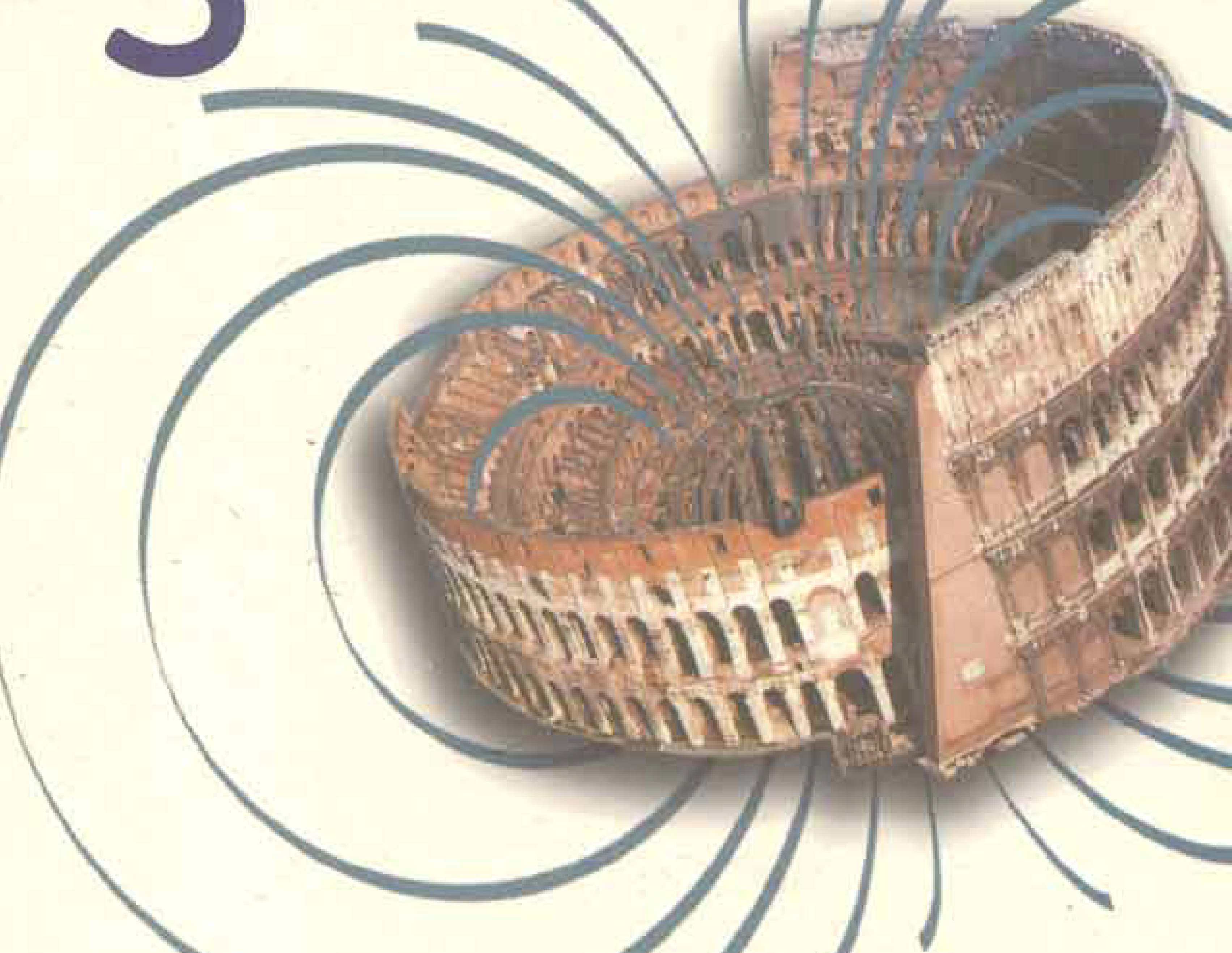
ICM 2003

ROMA, italy • july 27 – august 1 • 2003

international conference on Magnetism



Incorporating

The Symposium on Strongly Correlated Electron Systems

abstracts

4W-pm-06— MAGNETIC PROPERTIES OF Ce-SUBSTITUTED YTTRIUM IRON GARNET FERRITE THIN FILMS AND POWDERS FABRICATED USING A SOL-GEL METHOD

Jun Sig Kum, Sam Jin Kim, In-Bo Shim, and Chul Sung Kim
Dept. of Physics, Kookmin University, Seoul 136-702, South Korea

Compounds of composition $Y_{2.9}Ce_{0.1}Fe_5O_{12}$ thin films and powders were prepared using the sol-gel method. The crystallographic and magnetic properties of $Y_{2.9}Ce_{0.1}Fe_5O_{12}$ thin films and powders were studied using x-ray diffraction, vibrating sample magnetometry (VSM), atomic force microscope (AFM), scanning electron microscopy (SEM), and Mössbauer spectroscopy.
In order to explicit yttrium iron garnet (YIG), for microwave device, it showld have a lower magnetic coercivity as possible[1]. In this study, we present our analyses of coercivity in Ce doped YIG on the dependence of annealing temperature. $Y_{2.9}Ce_{0.1}Fe_5O_{12}$ powders which were annealed at and above 1200 °C had only a single phase garnet cubic structure and showed ferrimagnetic behaviors. Powders annealed at below 1200 °C had mixed phases of garnet and $YFeO_3$ structures. The magnetic behavior of $Y_{2.9}Ce_{0.1}Fe_5O_{12}$ powders fired at and above 800 °C showed that an increase of the annealing temperature yielded decrease in the coercivity and an increase in the saturation magnetization. The coercivity and the saturation magnetzatoin of $Y_{2.9}Ce_{0.1}Fe_5O_{12}$ powder annealed at 1400 °C had H_c = 5.8 Oe and M_s = 27.5 emu/g, respectively. $Y_{2.9}Ce_{0.1}Fe_5O_{12}$ thin films with homogeneous garnet phases was obtained form stock solutions spun on SiO_2/Si (100) substrates. Heat treatments were carried out at 600 ~ 800 °C for the films for 3h in air. The microstructure of the films consisted of spherical grains of 500-1000 Å in size and 60-150 Å in surface roughness (rms). The temperature dependence of the magnetic hyperfine field in ^{57}Fe nuclei at the tetrahedral (24*d*) and octahedral (16*a*) sites were analyzed based on the Néel theory of ferrimagnetism[2]. For $Y_{2.9}Ce_{0.1}Fe_5O_{12}$, the intersublattice *a-d* superexchange interaction was found to be antiferromagnetic with strength of $J_{a\text{-}d} = -21.42\ k_B$, while the intrasublattice interactions *a-a*, *d-d* were found to be ferromagnetic with a stregth of $J_{a\text{-}a} = 4.50\ k_B$ and $J_{d\text{-}d} = 0.02\ k_B$, respectively.

[1] M. Pardavi-Horvath, J. Mag. Magn. Mater. 215-216 (2000) 171
[2] C. S. Kim, Y. R. Uhm, S. B. Kim, and J. G. Lee, J. Magn. Magn. Mater. 215-216 (2000) 551