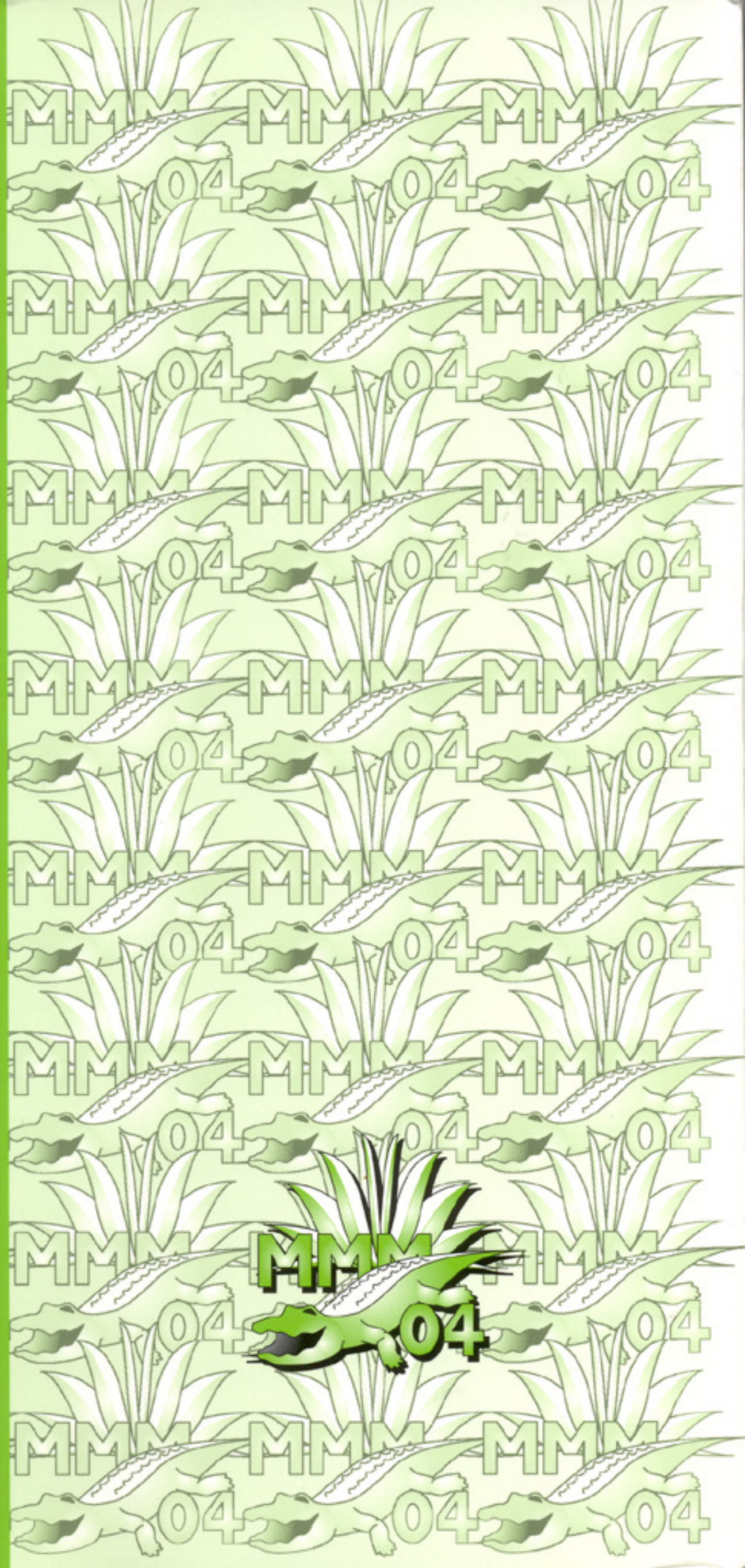
ABSTRACTS

49TH ANNUAL CONFERENCE ON MAGNETISM & MAGNETIC MATERIALS

JACKSONVILLE, FLORIDA
NOVEMBER 7-11, 2004



CS-04. Easy synthesis and characterization of γ-Fe2O3 nanoparticles for biomedical applications. *S. An*[1], I. Shim[1] and C. Kim[1] *1. Department of Physics, Kookmin University, Sungbuk-gu, Seoull, South Korea*

Easy synthesis of γ-Fe_2O_3 nanoparticles have been synthesized by sol-gel method using ONLY iron nitrate ($Fe(NO_3)_3 9H_2O$) under un Ar/H_2(5 %) bal-

ance gas atmosphere. The powders present average particle size of 7, 10, 13 nm with narrow size distribution for samples as-obtained and annealed at 150, 175 and 200 °C, respectively. Magnetic and structural properties of the powders were characterized with a MÖssbauer spectroscopy, vibrating sample magnetometer, x-ray diffraction, and transmission electron microscopy (TEM). At room temperature, 10 nm particles were partially superparamagnetic. The Mossbauer spectrum for the 7 nm samples at room temperature displays superparamagnetic behavior as demonstrated by the single quadrupole doublet with zero hyperfine fields. Superparamagnetic particles display no sextet in Mossbauer spectra at temperatures above blocking temperature (T_B = 165 K for 7 nm sample), which depends on the particle volume, anisotropy and so on. Note that the single quadrupole doublet represents the fraction of small particles in which long range magnetic ordering is absent. The hyperfine parameters for the sample are isomer shift δ=0.34 mm/s and *quadrupole* splitting E_Q= 0.92 mm/s, respectively. These values are typical of Fe^{3+} ions in the high-spin state, and we suggest that this sample should be a γ-Fe_2O_3. The spectrum for the 13 nm samples at room temperature shows a general sextet shape indicating ferrimagnetic behaviors. For this sample, the room temperature spectrum was fitted using two magnetic components of hyperfine fields H_{hf} = 490 and 460 kOe, isomer shifts δ = 0.31 and 0.39 mm/s corresponding to Fe^{3+} ions at sites A and Fe^{3+} ions at site B, respectively, with nearly null quadrupole splitting. It is considered that 7 nm samples are available for biomedical applications such as hyperthermia and drug delivery system as a magnetic fluid carrier because it has spherical shape, narrow particle distribution, chemical stability, and superparamagnetic behavior.