SECOND
SEEHEIM CONFERENCE ON
MAGNETISM

JUNE 27, 2004 – JULY 1, 2004
SEEHEIM, GERMANY

SCM2004
Second Seeheim Conference on Magnetism

PROGRAM AND ABSTRACTS

Supported by
Deutsche Forschungsgemeinschaft
Forschungszentrum Karlsruhe

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P-103 FERROMAGNETIC EFFECTS ON TRANSITION METAL DOPED Ga$_2$O$_3$-BASED SEMICONDUCTOR

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For the realization of spintronic device, it is essential to hybridize existing semiconductors with highly spin-polarized magnetic materials. Monoclinic gallium oxide, Ga$_2$O$_3$, is a wide band gap compound [E$_g$=4.9eV] which exhibits both conduction and luminescence properties. This work is an experimental investigation at the effects of transition metal(TM=Fe, Mn) doping on the structural and magnetic properties of the Ga$_2$O$_3$.

Ga$_{2-x}$TM$_x$O$_3$ (x = 0.00, 0.05, 0.10) powders were prepared with the sintering at 1200 $\degree$C in air atmosphere. The structure and magnetic properties for Ga$_{2-x}$TM$_x$O$_3$ (x = 0.00, 0.05, 0.10) powders have been studied with x-ray diffraction, vibrating sample magnetometer and a temperature dependence of resistance. The x-ray diffraction patterns of the Ga$_{2-x}$TM$_x$O$_3$ (x = 0.00, 0.05, 0.10) powders showed no detectable TM phase. All the peaks for the x-ray diffraction patterns of samples belong to the monoclinic(C2/m) lattice of Ga$_2$O$_3$. The lattice parameters for the Ga$_{1.95}$Fe$_{0.05}$O$_3$ and Ga$_{1.95}$Mn$_{0.05}$O$_3$ are found to be a = 12.235, b = 3.043 Å, c = 5.818 and a = 12.230, b = 3.044, c = 5.815 at room temperature. As the hysteresis curve at the room temperature for the Ga$_{2-x}$Fe$_x$O$_3$ (0.05, 0.10) powders was indicated with a paramagnetic and a ferromagnetic phases. As the doped TM increased, the magnetization value and ferromagnetic effect was increased, respectively.