ISAMMA 2010

The 2nd International Symposium on Advanced Magnetic Materials and Applications
July 12–16, 2010, Sendai, Japan

Abstracts

Organized by
The organizing committee of ISAMMA 2010

Sponsored by
The Magnetics Society of Japan
The Korean Magnetics Society
The Taiwan Association for Magnetic Technology
The Chinese Society for Magnetic Materials and Application
Vietnam Physical Society
The Data Storage Institute (Singapore)

QE-04

Neutron and Mössbauer studies of $LuFe_{2+x}O_4$

Sung Baek Kim[(a)], Il Jin Park[(a)], Bae Soon Son[(b)],and Chul Sung Kim[(a)]*

[(a)]Department of Physics, Kookmin University, 136-702 Seoul, Korea
[(b)]HANARO Center, Korea Atomic Energy Research Inst., 305-600 Deajeon, Korea
**e-mail: cskim@kookmin.ac.kr*

$LuFe_2O_4$ is the iron-based multiferroic system with a charge order, and crystallized in a layered hexagonal structure[1]. The unit cell consists of three Fe double layers with 2.5+ average nominal valence, which means Fe^{2+} and Fe^{3+} ion occupy the equivalent hexagonal site with equal density[2]. Herein, we have explored crystallographic and magnetic properties of $LuFe_{2+x}O_4$ in order to study on the change of charge order state in the $LuFe_2O_4$ system.

Polycrystalline $LuFe_{2+x}O_4$, with a nominal Fe content of $x=0.0 \sim 1.0$, was synthesized via solid-state reaction method. The x-ray and neutron diffraction patterns show quite single phase for the $LuFe_{2+x}O_4$, which is from $x=0.0$ to $x=0.9$. The $x=1.0$ samples appear a small mixed Fe_2O_3 phase. From this result of neutron diffraction, the Fe atoms can be intercalated to $x=0.9$ concentration into between Lu oxide layers without structure transition.

Magnetization was performed in a Quantum Design Magnetic Properties Measurement System. The zero-field cooled(ZFC) magnetization curves of all $LuFe_{2+x}O_4$ show magnetic transition at 235 K. More than $x=0.5$ samples, it is noted that the ZFC curves shows another abnormal peaks around 120 K. It can be interpreted a spin reorientation caused by strong correlation between excess Fe ions. In order to investigate the microscopic interaction mechanism, we have taken Mössbauer spectra at various temperatures. In the $LuFe_{2.9}O_4$ sample, the Mössbauer spectra show three Fe^{3+} sextets and a Fe^{2+} sextet. From the analysed hyperfine parameters of Mössbauer spectra[3], it can be accessed an understanding for the change effects of charge order state and an origin of abnormal magnetic transitions in the $LuFe_{2+x}O_4$ system.

This work was supported by Nuclear Research & Development Program and Basic Science Research Program through the National Research Foundation (NRF) grant funded by the Korean government(MEST). (grant code : 2009-0072143 & 2009-0081013)

[1] N. Ikeda *et al*, Nature **436**, 1136 (2005).
[2] K.-T. Ko *et al*, Phys. Rev. Lett. **103**, 207202 (2009).
[3] Bong Kyu Bang *et al*, J. Appl. Phys. **103**, 07E307 (2008).