



ISAMMA2007

The 1st International Symposium on Advanced Magnetic Materials
May 28-June 1, 2007, Jeju, Korea



Organized by

Research Center for Advanced Magnetic Materials
The Korean Magnetics Society

Sponsored by

Korea Science and Engineering Foundation
Korean Federation of Science and Technology Societies
Research Center for Spin Dynamics and Spin-Wave Devices

Magnetic Properties of Iron Doped TiO₂ by Proton Irradiation

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Recent research indicate ferromagnetism in graphite by proton irradiation[1-2]. Also, as the roles of oxygen vacancies or defects have been embossed in oxide diluted magnetic semiconductor, the appearance of new consideration which can account for the ferromagnetism has been required and suggested [3] We have investigated the magnetic properties of ⁵⁷Fe-doped TiO₂ compounds induced by proton irradiation at various time. The x-ray diffraction patterns for all samples showed an anatase single phase and the crystal structure was determined to be a tetragonal structure with a space group *I4₁/amd*. Magnetic moments enhanced by increasing proton irradiation time. Mössbauer spectra of proton irradiated Ti_{0.99}⁵⁷Fe_{0.01}O₂ samples were taken at 295 K. The spectra consist of the wing (sextet) and the central (doublet), suggesting that the magnetically ordered (MO) phase and the paramagnetic (PM) phase, respectively. Increasing proton irradiation time, part of the Fe³⁺ ions were converted to Fe²⁺ ions by compensation charge. It could be, therefore, evidenced that the enhancement of magnetic moment after proton irradiation is contributed to the moment by the spin-orbit coupling of Fe²⁺ ions.

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