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Magnetic Properties of Iron Doped TiO$_2$ 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 $^{57}$Fe-doped TiO$_2$ 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 $I4_1/amd$. Magnetic moments enhanced by increasing proton irradiation time. Mössbauer spectra of proton irradiated Ti$_{0.99}^{57}$Fe$_{0.01}$O$_2$ 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 Fe$^{3+}$ ions were converted to Fe$^{2+}$ 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 Fe$^{2+}$ ions.

REFERENCES

