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The magnetic phase transition in titanium oxide induced by proton irradiation

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ABSTRACT

We have studied the magnetic properties of ^{57}Fe-doped TiO_2 compounds irradiated by proton with 0, 5 and 10 pC/μm^2. We have observed the enhancement of the magnetic moment, measured by superconducting quantum interference device magnetometer, with increasing proton irradiation ranging from 0 to 10 pC/μm^2. Mössbauer spectra of proton irradiated $Ti^{57}_{0.99}Fe_{0.01}O_2$ samples were taken at room temperature. Two sites of the wing (sextet) and the central (doublet) are shown in the spectra, which suggest the magnetically ordered phase and the paramagnetic phase, respectively. With increasing proton irradiation, the part of Fe^{3+} ions was converted to Fe^{2+} ions by compensation charge. This clearly suggests that the enhancement of magnetic moment after proton irradiation is contributed to the moment by the spin-orbit coupling of Fe^{2+} ions.