

Strong out-of-plane magnetic anisotropy in ion irradiated anatase TiO₂ thin films

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The temperature and field dependence of the magnetization of undoped anatase TiO₂ thin films on SrTiO₃ substrates was investigated. Low-energy ion irradiation was used to modify the surface of the films within a few nanometers. The as-prepared thin film shows ferromagnetism which increases after irradiation. A magnetic anisotropy opposite to the expected form anisotropy, was observed after the first irradiation. Titanium vacancies as di-Frenkel pairs appear to be responsible for the ferromagnetism and the strong anisotropy. Magnetic impurities are ruled out as a source of the ferromagnetism by means of particle-induced X-ray emission measurements.