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abstracts
FQ-13. Ferromagnetic Properties of Anatase Ti_{1-x}Fe_{x}O_{2-\delta} Thin Films.
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Magnetic and electronic properties of Fe-doped anatase TiO_{2-\delta} thin films grown on Al_{2}O_{3}(0001) substrates by a sol-gel method have been investigated by vibrating-sample magnetometry (VSM), conversion electron Mössbauer spectroscopy (CEMS), and Hall effect measurements. Anatase Ti_{1-x}Fe_{x}O_{2-\delta} thin films were found to exhibit ferromagnetism at room temperature by VSM with the saturation magnetic moment up to 2 \mu B per Fe ion. The isomer shifts in CEMS are 0.26-0.28 mm/s, indicating a ferric character. The CEMS spectra also revealed that Fe^{3+} ions mostly substitute the octahedral Ti^{4+} sites of Ti_{1-x}Fe_{x}O_{2-\delta}. The Ti_{1-x}Fe_{x}O_{2-\delta} films exhibited poor electrical conductivity with p-type character. The ferromagnetism in the present Ti_{1-x}Fe_{x}O_{2-\delta} films can be explained in terms of a direct ferromagnetic coupling between two neighboring Fe^{3+} ions via an electron trapped in oxygen vacancy. The observed decrease of the net magnetization with the increase of the Fe content is attributable to an increase of antiferromagnetic superexchange interaction between two neighboring Fe^{3+} ions via O^{2-} ion.