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Insulator-ferromagnetic metal transition in anatase Fe:TiO_2 ENJU SAKAI, The University of Tokyo, YASUSHI HIROSE, KAST, TARO HITOSUGI, TOSHIHIRO SHIMADA, TETSUYA HASEGAWA, The University of Tokyo, KAST
— Local Fe valence states in Fe-doped anatase TiO_2 (Fe:TiO_2) were investigated in relation with transport and magnetic properties. Anatase Fe:TiO_2 films were deposited on $LaAlO_3$ (100) substrates by pulsed laser deposition technique. Amounts of oxygen vacancies in the films were controlled by varying partial oxygen pressure during deposition (P_{O_2}). Magnetic and transport properties of the synthesized Fe:TiO_2 films measured by SQUID and conventional fourt probe measurements. An insulator-ferromagnetic metal transition was clearly observed between P_{O_2}= 1×10^{-6} and 3×10^{-6} Torr. X-ray photoemission spectroscopy (XPS) measurements have revealed that the local Fe valence state changes from 3+ to 2+, accompanied with the insulator- ferromagnetic metal transition. These results strongly suggest that carriers bound to Fe-oxygen vacancy pairs form magnetic polarons, and that mutual overlap of magnetic polarons triggers the insulator to ferromagnetic metal transition in Fe:TiO_2.

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