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Enhanced Magnetism in Fe-Doped TiO_2 Anatase Nanorods[1] YI DING, L. H. LEWIS, WEI-QIANG HAN, Brookhaven National Laboratory — In addition to the applied interest concerning dilute magnetic semiconductors, ferromagnetism in d^0 oxides is of fundamental interest in understanding the interaction character between magnetic impurities in insulating systems. We report here simultaneous ferromagnetism and enhanced Pauli Paramagnetism in TiO_2 anatase nanorods doped with nominal 0.5 at% Fe, synthesized by a hydrothermal route followed by low-temperature heating in air. The resultant nanorods are $\sim$ 20 nm in width and several hundreds nanometers in length. Transmission electron microscopy (TEM) reveals that the Fe concentration ranges from 0.3 at% - 0.8 at% within the nanorods. No evidence of pure iron nanoparticles in the sample is detected with TEM or with synchrotron diffraction. SQUID magnetometry performed in the temperature range 10 K $\leq$ T $\leq$ 800 K in fields up to 1 T show clear ferromagnetism at low fields that transitions to paramagnetic behavior at higher fields. Decomposition of demagnetization curves reveals that the nanorods possess Pauli paramagnetism that is over 100 times larger than that of pure bulk anatase TiO_2 as well as ferromagnetism that persists to temperatures slightly above 800 K. It is hypothesized that the Pauli paramagnetism originates from anatase regions with lower Fe doping, while the ferromagnetism originates from regions of higher Fe doping, suggesting a percolative mechanism for ferromagnetism.

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