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Room temperature ferromagnetism in Fe-doped TiO_2 films is unrelated to magnetic ordering of iron. M VENKATESAN, CRANN and School of Physics, Trinity College, Dublin 2. Ireland, R.D. GUNNING, J.M.D. COEY, MANSE TEAM — $TiO_{2-\delta}$ films doped with x = 1 – 5 at.% ^{57}Fe produced in oxidizing or reducing conditions by pulsed laser deposition on sapphire substrates exhibit ferromagnetic behaviour at room temperature. Conversion electron Mössbauer spectra show that most of the iron in the oxidized film (10^2 Pa) is present as paramagnetic Fe^{3+} or Fe^{2+}whereas in the reduced films (10^{-3} Pa) most of the iron is present as well-crystallized iron metal. The moment per iron atom for 1% and 5% films significantly exceeds the value of 2.2 μ_B for iron metal and in the 1% oxidized film it is as much as 6.9 μ_B per iron atom. Films where the dopant ions are not magnetically ordered possess some of the largest ferromagnetic moments. Saturation moments are in the range 2-20.10^{-8} Am^2 or 90-900 μ_B nm^{-2} of substrate area. The iron in these oxidized films is in Fe^{3+} or Fe^{2+} state, but it is *not magnetically ordered* and cannot therefore contribute to the observed ferromagnetic moments. The isomer shifts indicate octahedral oxygen co-ordination for both ions. We conclude that Fe-doped TiO_2 cannot be regarded as dilute magnetic semiconductor. The magnetism of this, and may be that of many other dilute magnetic oxides might be explained in terms of oxygen-based electronic defects, or orbital currents which do not involve the dopant directly.

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