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Charge transfer ferromagnetism in defect-ridden oxide films MICHAEL COEY, PLAMEN STAMENOV, MUNUSWAMI VENKATESAN, School of Physics, Trinity College Dublin — Ferromagnetic magnetization curve of certain oxide thin films, whether undoped or doped $3d$ ions, shows a characteristic anhysteretic approach to saturation of the form $M \approx M_s \tanh(H/H_0)$, which is *independent of temperature* below RT. There is no magnetic ordering of the dopant ions, but ferromagnetism is associated with Stoner splitting of a defect-related impurity band. In a model of ferromagnetic grain boundaries, $H_0 = 0.16\ M_0$, where M_0 is the magnetization of the ferromagnetic regions. Data mining on six oxide systems shows that *no more than 1 – 2 % of the volume of the films is magnetically ordered*. Charge transfer ferromagnetism arises when the impurity band can be populated from a proximate charge reservoir. Changing electron concentration leads to fulfillment of the Stomer criterion. There is a rich phase diagram as a function of bandwidth W, Stoner integral I and band occupancy (which is related to the cost of electron transfer U) with metallic and insulating regions which may be ferromagnetic, half metallic or nonmagnetic, consistent with behavior as a function of electron concentration observed experimentally. Our model of sparse Stoner ferromagnetism with variable electron concentration accounts consistently for the main experimental features of these puzzling materials.

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