Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Producing room temperature ferromagnetism by doping non-magnetic Ta ions in transparent conducting anatase TiO_2 thin film S. DHAR, A. RUSIDY, A. ROY BARMAN, A. ARIANDO, B.C. QI, J.B. YI, Y.P. FENG, K. YANG, J. DING, A.T.S. WEE, T. VENKATESAN, NanoCore, G. NEUBER, M. RUEBHAUSEN, Hamburgh, Y. DAI, Shandong , H. HILGENKAMP, Twente, NANOCORE, NUS SINGAPORE TEAM, UNI HAMBURGH COLLABORATION, SHANDONG U COLLABORATION, U TWENTE COLLABORATION
— Anatase TiO_2 is being explored for fabrication of various spintronic, magneto-optic, opto-electronic, and memory devices. The keys to these technologies are our ability to control the magnetic, and transport properties of the host TiO2. In this work, we present the recent discoveries of room-temperature half-metallic ferromagnetism in non-magnetic Ta-doped anatase TiO_2 thin films prepared by pulsed laser deposition. Spin-polarized ferromagnetism with large carrier densities has been observed by a combination of SQUID magnetometry, XMCD, XAS, and OMCD. The results show that 90% of the contribution to the ferromagnetism originates from the Ti sites and the remaining 10% from the O sites. The OMCD results supported by band structure calculation, validates the half-metallicity of this ferromagnetic system. These results indicate that the magnetic moments at the Ti^{3+} and Ti vacancy sites, are ordered ferromagnetically by the itinerant carriers via a Ruderman-Kittel-Kasuya-Yosida mechanism.

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Date submitted: 25 Nov 2009 Electronic form version 1.4