Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

Electric Field Modulation of Ferromagnetism in Diluted Magnetic Insulating Co:TiO_2 T. ZHAO, Univ. of Maryland, College Park; Univ. of California, Berkeley, S.R. SHINDE, S.B. OGALE, H. ZHENG, Univ. of Maryland, College Park, T. VENKATESAN, S. DAS SARMA, Univ. of maryland, College Park, J. MISEWICH, Brookhaven National Laboratory, R. RAMESH, Univ. of California, Berkeley — In this work we report the first successful implementation of an external electric field modulation of ferromagnetism in an oxide-based diluted magnetic system. An anatase TiO_2layer with 7% Co doping and a ferroelectric $PbZr_{0.2}Ti_{0.8}O_3$(PZT) layer were epitaxially grown on a conducting $SrRuO_3$buffered $LaAlO_3$ substrate by pulsed laser deposition. The Co:TiO_2 channel grown in this case at a high temperature of 875 ^{0}C is insulating in nature. The magnetic hysteresis loops of the Co:TiO_2 were measured by SQUID after positive or negative electric poling on PZT. A 15% difference in the room temperature saturated magnetic moment as well as the coercive filed of Co:TiO_2 is observed according to the two polarization states of PZT, which can be modulated over several cycles. This first demonstration of electric field effect in an oxide based diluted ferromagnetic insulator system provides evidence of its intrinsic nature. Possible mechanisms for insulating ferromagnetism and its modulation by an electric field are discussed. This work was supported by DARPA SpinS program (through US-ONR) and the NSF-MRSEC (DMR 00-80008) at Maryland and by a grant from Brookhaven National Laboratory.

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Date submitted: 29 Nov 2004 Electronic form version 1.4