Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

**Room temperature ferromagnetism in transition metal (Fe, CO) doped $TiO_2$ spin-coated films** P. KHAREL, P. TALAGALA, G. LAWES, R. NAIK, G.W. AUNER, Wayne State University, Detroit, MI, V.M. NAIK, University of Michigan-Dearborn, R. SURYANARAYANAN, LPCES, Université Paris-Sud, 91405 Orsay, France — We have prepared transition metal (TM) doped ($\sim$ 5 at %) $TiO_2$ films in both anatase and rutile forms by metalorganic decomposition using a simple spin-coating technique. The appropriate metalorganic precursor solutions were mixed and spin-coated on to sapphire substrates held at room temperature and subjected to pyrolysis in a furnace at 500°C for 2 minutes to obtain one coat. Films ranging in thickness from 200 to 800 nm were prepared by increasing the number of coats. Further annealing of the films in air at 550°C yields only anatase form of TM doped $TiO_2$ whereas annealing at 750°C results in rutile form as confirmed by X-ray diffraction and Raman scattering. The films were found to be only weakly ferromagnetic at 5 K and paramagnetic at room temperature. However, when these films were annealed in a vacuum of $2x10^{-5}$ Torr between 500 to 600°C, clear signatures of ferromagnetism appeared at room temperature for both anatase and rutile forms. The highest coercivity obtained in our anatase form of Fe doped $TiO_2$ sample was 720 Oe at 5K and 450 Oe at 350 K similar to earlier data on laser ablated films. The effect of heat treatment on the magnetic properties and the role played by oxygen defects will be discussed.

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Date submitted: 15 Dec 2004 Electronic form version 1.4