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Room temperature ferromagnetism in cluster free, Co doped Y_2O_3 dilute magnetic oxide C.N. WU, S.Y. HUANG, W.C. LIN, T.S. WU, Y.L. SOO, Dept. of Physics, National Tsing Hua Univ., Taiwan, W.C. LEE, Y.J. LEE, Y.H. CHANG, M. HONG, Dept. of Materials science and Engineering, National Tsing Hua Univ., Taiwan, J. KWO, Dept. of Physics, National Tsing Hua Univ., Taiwan; Center for Condensed Matter Sciences, National Taiwan Univ, Taiwan — Diluted magnetic oxides (DMO) displaying the ferromagnetic behavior far above room temperature has attracted much attention for potential spintronic applications. Our study using low temperature co-deposition has produced uniformly doping of transitional metal (TM) Co (2-10 at.%) in Y_2O_3 films without formation of clusters or second phases, stable up to 450 $^\circ$C anneals under most ambient. This was confirmed by EXAFS local structural analysis, XANES, and XMCD measurement. Ferromagnetic behavior of magnetic moment was observed at 300K, and the Co saturation magnetization was modulated by the concentration of oxygen vacancies under various post treatments. The observation is consistent with the impurity band exchange model to account for apparent ferromagnetism in these nearly insulating DMO films. One surprising implication from this model is the occurrence of ferromagnetic insulator behavior in TM doped HfO_2 is more likely than the widely studied TM doped ZnO, TiO_2, and SnO_2 systems of smaller band gaps for doping concentrations kept under cation percolation threshold.

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