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Metastable defect ferromagnetic phases by low temperature interface reactions between transition metal oxides DARSHAN C. KUNDALIYA, S.B. OGALE, S.R. SHINDE, M.S.R. RAO, T. VENKATESAN, Center for Superconductivity Research, Department of Physics, University of Maryland, College Park, MD-20742, S.E. LOFLAND, Department of Physics and Astronomy, Rowan University, Glassboro, NJ 08028-1701 — Recently we showed [Nature Materials 3, 709 (2004)] that the room temperature ferromagnetism observed in low temperature (500 °C) processed mixtures of 2 at% MnO₂ with ZnO [Nature Materials 2, 673 (2003)] is caused by an interface phase suggested to be of the form Mn_{2-x}Zn_xO_{3-δ}, wherein Zn is incorporated into Mn₂O₃. In order to establish the anticipated generic nature of the process, experiments were performed on low temperature sintering of 2 at% MnO₂ with other transition metal oxides such as NiO, TiO₂ or CuO. Room temperature ferromagnetism was observed in all the three cases. Our results suggest that ferromagnetism in these new cases also resides at the interface. The same mixtures when sintered at 800 °C resulted in compound phases (e.g. NiMn₂O₄ in the Ni-Mn-O case) that are nonmagnetic at room temperature. We suggest a new mechanism of ferromagnetism based on the valence and spin controlled defect state in the interface phases.

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