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**Insulating Domain Walls in Mixed Phase Manganite** GUNEETA SINGH BHALLA, S. SELCUK, T. DHAKAL, A. BISWAS, A.F. HEBARD — We present here evidence of *novel* insulating domain walls (IDWs) which allow direct tunneling of spin polarized currents in thin films of the mixed phase ferromagnet (La,Pr,Ca)$MnO_3$. Elastic interactions in the distorted perovskite structure of (La,Pr,Ca)$MnO_3$ coupled with magnetostatic interactions give rise to coexisting ferromagnetic metallic and insulating regions near the Curie temperature, $T_C$. Well below $T_C$, magnetization measurements reveal that the mixed phase metal/insulator state evolves into a fully saturated ferromagnetic metallic state. However, when either the film thickness is reduced, or a thicker film is patterned into a nanometer wide bridge structure, the formation of domain structure is modified as theoretically predicted for mixed phase ferromagnets, resulting in thin IDWs separating adjacent half-metallic domains. Experimentally we observe that upon cooling below $T_C$, a predominantly ferromagnetic supercooled state persists where remnants of the insulating regions behave as IDWs within the bridge. Tunneling across IDWs results in metastable, temperature-independent, high-resistance plateaus over a large range of temperatures below $T_C$. Upon application of fields on the order of the coercive field, neighboring domains align and the IDWs are extinguished resulting in sharp, colossal resistance drops. The presence of IDWs offers rich physical insights into ferromagnetic domain formation in mixed phase systems.

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