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Properties of the Predicted Multiferroic $Ca_3Mn_2O_7$ - Experiment

R. MISRA, The Pennsylvania State University, University Park, PA, C. ADAMO, N.A. BENEDEK, Cornell University, NY, S.A. DENEV, A. SENGUPTA, The Pennsylvania State University, University Park, PA, J.A. MUNDY, Cornell University, NY, J.H. LEE, The Pennsylvania State University, University Park, PA, D.A. MULLER, Cornell University, NY, V. GOPALAN, The Pennsylvania State University, University Park, PA, C.J. FENNIE, D.G. SCHLOM, Cornell University, NY, P. SCHIFFER, The Pennsylvania State University, University Park, PA — We have studied the properties of epitaxial films of $Ca_3Mn_2O_7$, an $n = 2$ Ruddlesden-Popper phase. This material has been predicted to have novel multiferroic properties, including electric field switching of the magnetization [1]. 50 nm thick unstrained $Ca_3Mn_2O_7$ films were grown by reactive MBE on (110) $YAlO_3$ single crystal substrates. XRD shows that the $Ca_3Mn_2O_7$ films are single phase and epitaxial with (001) $Ca_3Mn_2O_7$ // (110) $YAlO_3$. Our films show a transition to a weakly ferromagnetic or canted antiferromagnetic state below 120K. The magnetic properties have strong anisotropy with a clear transition visible with an in-plane applied field, but none along the out of plane direction. Second harmonic generation results show that a weak polar order exists at room temperature and it persists until $\sim$700°C. We also report on the low temperature dielectric properties of the material.

[1] N. A. Benedek and C. J. Fennie, arXiv:1007.1003v1.

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