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Self-Assembled Single Crystal Ferromagnetic Fe and Co Nanowires Formed by Decomposition L. MOHADDES-ARDABILI, U C Berkeley, H. ZHENG, U C Berkeley, S.B. OGALE, University of Maryland , F. ZAVALICHE, Univ of Maryland and U C Berkeley, L. SALAMANCA-RIBA, Univ of Maryland , D.G. SCHLOM, Penn State University, R. RAMESH, U C Berkeley — A novel approach to create self-assembled ferromagnetic nanostructures for new magnetic recording media with high storage capacity is reported, which involves spontaneous phase decomposition of a single-phase perovskite oxide during film growth. We are exploring the stability in a nominally single phase $LaSrTMO_3$ (TM = Fe, Co, Mn) system as a function of oxygen pressure, using thin film heteroepitaxy as the processing route. We find that the film microstructure depends systematically on the oxygen pressure during deposition. Deposition under reducing environments, leads to the formation of self-assembled arrays of nanowires. In the case of Fe system the deposition under reducing conditions leads to spontaneous formation of an array of single crystalline ferromagnetic α-Fe nanowires embedded in an antiferromagnetic matrix with nominal compostion of $LaSrFeO_4$. The diameter of both α-Fe and Co nanowires is controlled by growth temperature and the height is controlled by film thickness. The magnetic properties of these nanowires are both dependant on the average diameter and also the height of nanowires. The large remanence and sizable coercivity of the nanowires make them desirable for high-density data storage and other magnetic device applications.

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