Electronic Supplementary Information

High Pressure Synthesis, Structure, and Multiferroic Properties of Two Perovskite Compounds Y_2FeMnO_6 and Y_2CrMnO_6

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Figure S01. Powder XRD partten of YFMO

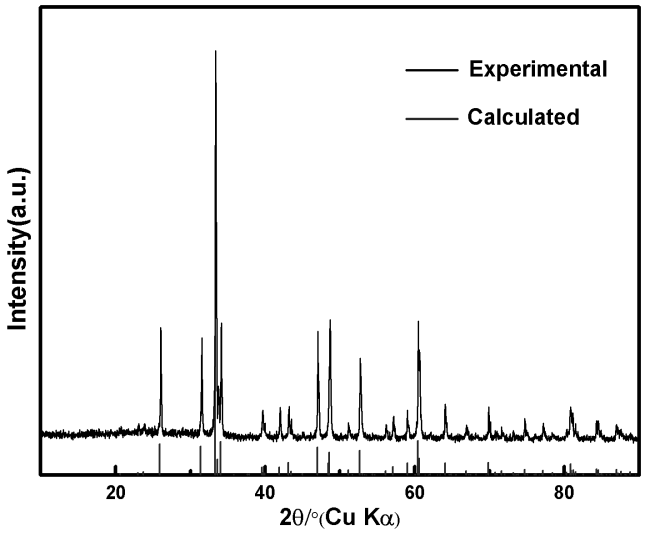

Figure S01. The experimental pattern was in close agreement with that calculated from the single-crystal data, and no secondary phase was detected.

Figure S02. The EDS spectrum of: (a) Y_2CrMnO_6 and (b) Y_2FeMnO_6

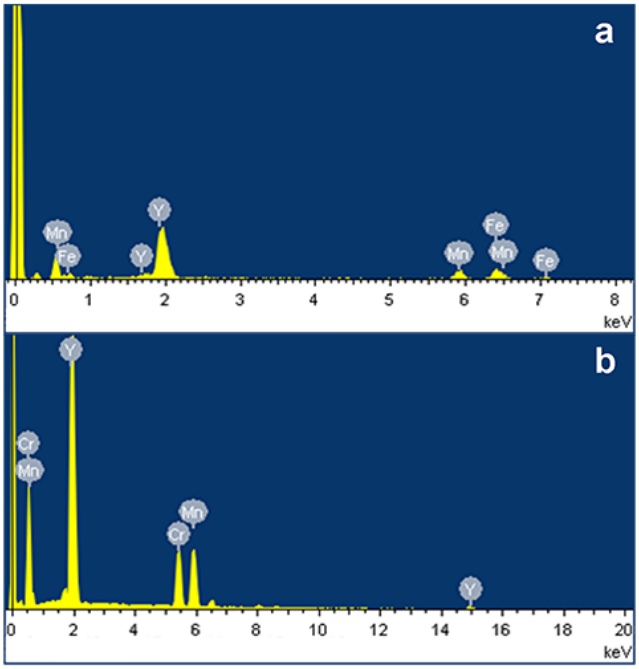

Figure S02. EDS spectrum of: (a) Y_2CrMnO_6 (at%: Y/Cr/Mn= 1.01/0.5/0.49) and (b) Y_2FeMnO_6 (at%: Y/Fe/Mn= 1.13/0.45/0.42). The EDS of YCMO and YFMO were observed using SEM (JSM-6700F, JEOL, Japan) equipped with energy dispersive X-ray spectroscopy.

Figure S03. SEM image of YCMO synthesized under ambient pressure

The YCMO samples obtained under ambient pressure (AP-YCMO) was examined. The impurities can be seen in the SEM image and the powder X-ray diffraction pattern. Though there was no other extra peaks appeared in the X-Ray Diffraction (XRD) result, we have sufficient reason to believe that a trace amount of Mn_2O_3 and Cr_2O_3 is left over which have not be examined by XRD method. The unreasonable inflection point at 25K in the ZFC curve and the wasp-waist hysteresis loop at 5K suggest that the impurities which have not been detected by the XRD method seriously affect the magnetism data.

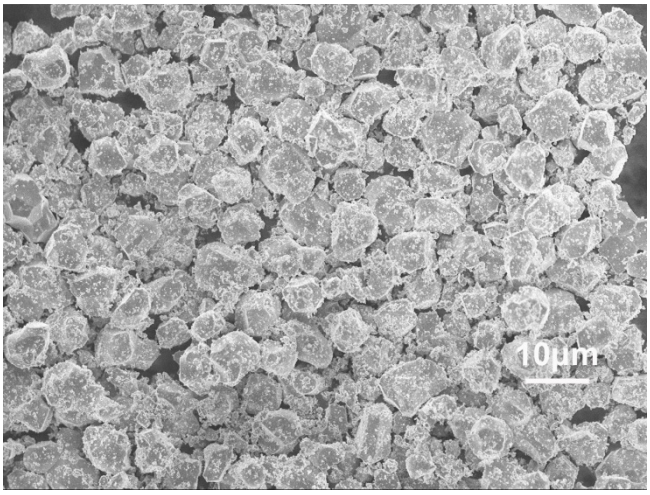

Figure S04. Observed and calculated X-ray diffraction pattern of AP-YCMO at room temperature

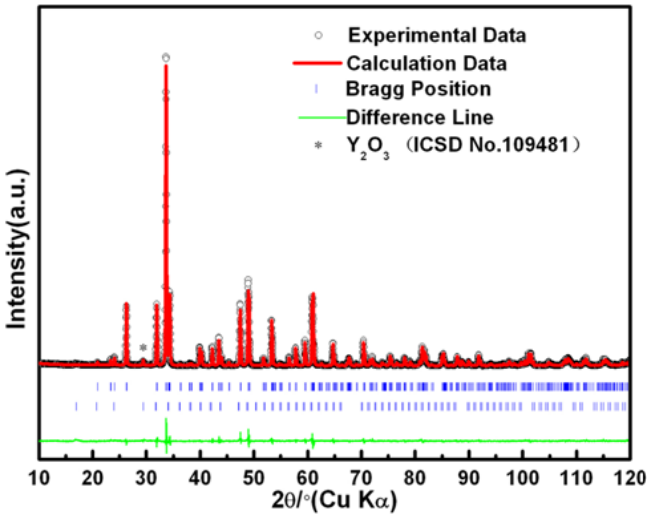

Figure S04. Observed and calculated X-ray diffraction pattern of AP-YCMO at room temperature. Y_2O_3 (neither ferroelectric nor magnetic) impurity phase was indicated by an asterisk.

Figure S05. Temperature-dependent magnetization curves and hysteresis loops of AP-YCMO

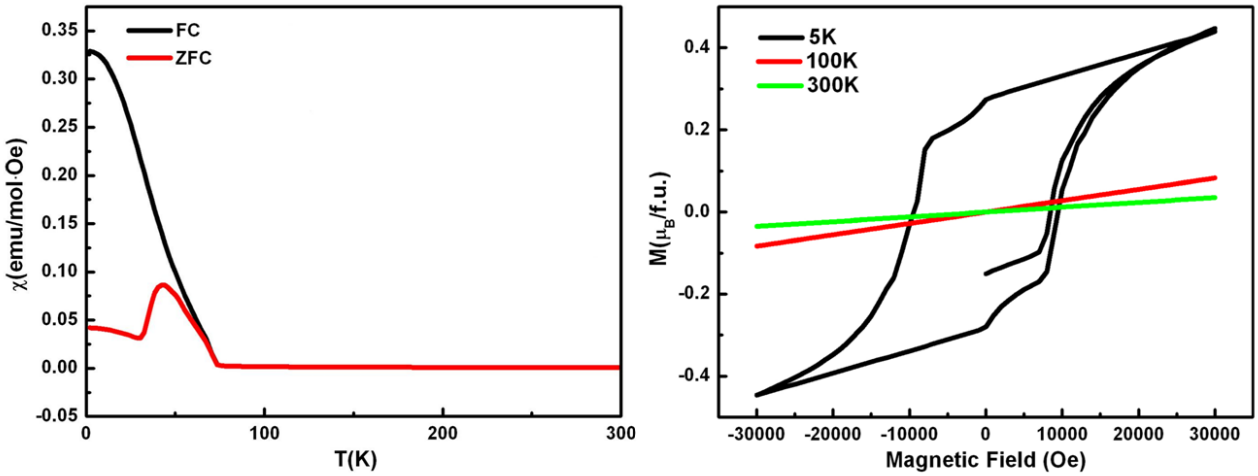

Figure S05. Temperature-dependent magnetization curves (a) and hysteresis loops (b) recorded of AP-YCMO. Molar susceptibility versus temperature curves showing three anomalies at 25, 50 and 70 K. The unreasonable inflection point at 25K in the ZFC curve and the wasp-waist hysteresis loop at 5K suggest that the impurities which have not been detected by the XRD method seriously affect the magnetism data.

Figure S06. PUND (positive-up & negative-down) pulse result of Y_2FeMnO_6 at 77 K

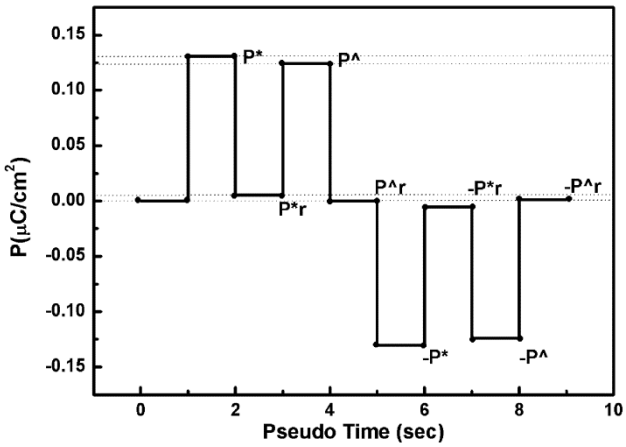

Figure S06. PUND (positive-up & negative-down) pulse result of YFMO at 77 K. The PUND result was obtained by employing the pulse width of 10 μsec and the delay time of 1000 msec. The saturation value of the polarization was obtained by applying an electric field of 50 kV/cm. The net switching polarization (2Pr) was evaluated using the following relation: (2Pr) = (±P*)−(±P^). Remanent polarization Pr value obtained from the PUND study is ~0.006 μC/cm^2.

Table S01. Structure Parameters for Orthorhombic YFMO

atom	Wyckoff site	x	y	z	$U_{iso}(Å^2)$
Y	4c	0.576(0)	0.250(0)	1.017(9)	0.007(7)
Mn (Fe)	4a	1.000(0)	0.500(0)	1.000(0)	0.005(0)
O1	4c	1.038(0)	0.750(0)	1.110(9)	0.009(4)
O2	8d	1.184(0)	0.555(3)	0.696(7)	0.009(3)