


Room-temperature multiferroic behavior in layer-structured Aurivillius phase ceramics

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CRYOTRONICS

~ 494 K
 $B_6FC_{3O_{18}}$ (526 K).²³
 BLFC
 $F^{3+} O F^{3+}, C_a^{3+} O C_a^{3+}, F^{3+} O C^{3+}$ (\dots).²⁴
 ED
 FC
 ~ 353 K
 $C_2F_2O_4$
 $C_2F_2O_4$ (460 K)
 (M) $C_2F_2O_4$.^{16,25}
 16.235 / \dots
 $C_{2-} F_a O_4$ 0.22 0.32 / \dots
 $M = 1.85$ / $F_a \cdot 2(\dots)$ I_a $M H$
 $2(F_a \cdot 3)$ 425 K 1.58 / \dots 0.27 / \dots ED
 $BLFC$
 $F_a \cdot 3$
 (DF) $F^{3+} O C^{3+}$ *ab initio*
 $(A P)$ H_a
 $F = 2$ $C = 3$ F_a C_a
 $(GGA) + \dots I$
 $BLFC$ F^{3+} C^{3+} (3.1 $2.1 \mu_B/a$)
 $0.1 \mu_B/a$
 $F O_6$ $C O_6$ F/C $F \cdot 3(\dots)$
 F_a O_a F^{3+} C^{3+}
 (\dots) (\dots)
 $E_{FM} - E_{AFM}$
 $= -144.1$
 H_a 43.5 ($\dots, 504.6$ K), (FM) FM
 FC/FC $F \cdot 2(\dots)$ $a b$
 010
 $BLFC$ $F_a \cdot 4$ I_a
 $BLFC$ PFM $BLFC$ 399 O F P

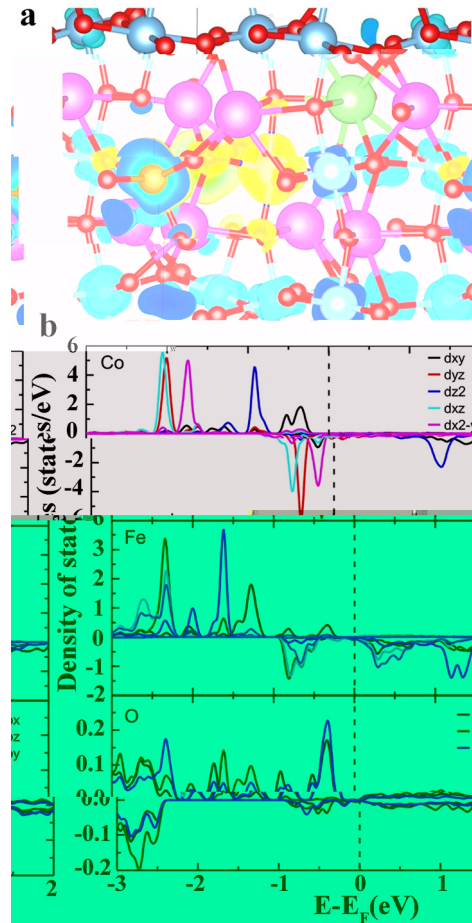


FIG. 3. (a) Crystal structure of BLFC. (b) Density of states (DOS) for Co, Fe, and O atoms. The DOS is calculated using the GGA+U method with $U = 0.005$ eV. The legend indicates the contributions from different orbitals: dxy (black), dyz (red), dz2 (blue), dxz (green), and dx2-y2 (magenta).

N
 I $F_a \cdot 4$ $(0, 1, 20)$
 $(2 \leq H < 5)$
 $M H$ $F_a \cdot 2(\dots)$ $3_a F$
 $BLFC$ P F M
 PFM $BLFC$ 399 O F P

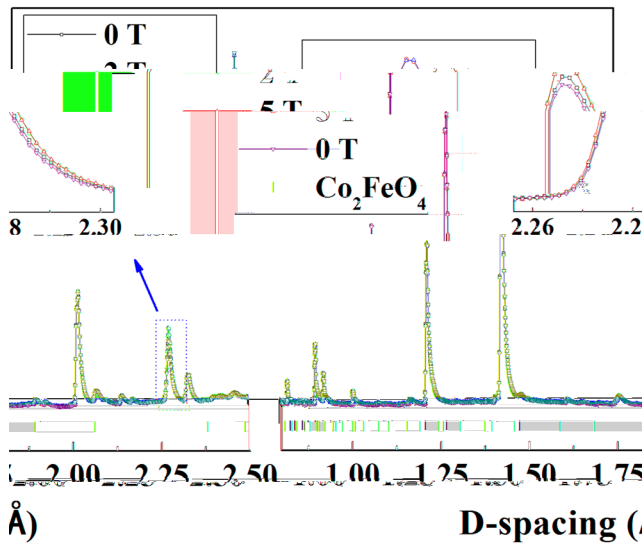


FIG. 4. XRD patterns of Co_2FeO_4 at 0 T and 5 T. The inset shows the experimental setup.

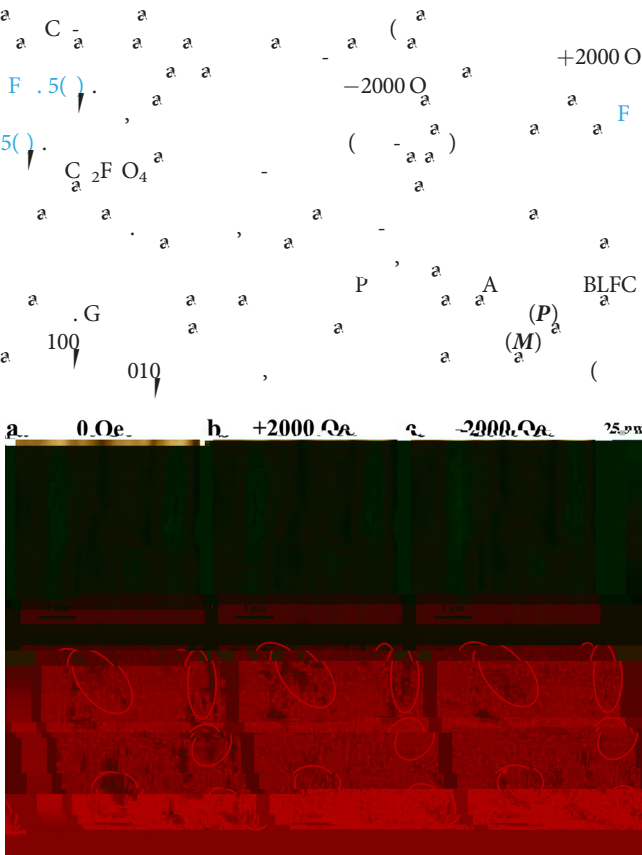


FIG. 5. MFM images of Co_2FeO_4 at 0 Oe, +2000 Oe, and -2000 Oe. The scale bar is 25.0 nm.

$T = P \times M$
 BLFC
 $\text{C}^{3+} \text{O}_2 \text{C}^{3+} \text{F}^{3+} \text{O}_2 \text{C}^{3+}$
 $\text{F}^{3+} \text{O}_2 \text{C}^{3+}$
 $\text{F}^{3+} \text{O}_2 \text{F}^{3+}$
 $\text{C}_2\text{F}_2\text{O}_4$
 EM (ED)
 $\text{D} \cdot \text{M}^a, \text{P}^a, \text{D} \cdot \text{K}^a, \text{D}.$
 $\text{I H}, \text{I I N}, \text{AL}_2$
 $\text{D}^a, \text{O}, \text{K}.$
 $\text{A}^a \text{E}, \text{D}^a \text{F}, \text{G}^a \text{A}, \text{A}^a \text{A}^a \text{G}^a \text{N}^a / 2 /$
 $0038/20), \text{C}^a (\text{G}^a \text{N}^a \text{K2015-0602006}), \text{N}^a \text{FC}^a (\text{G}^a$
 $\text{N}^a \text{11474138}, \text{11834005}). \text{A}^a \text{P}^a (\text{EM P})$
 $\text{P}^a \text{IND54}^a \text{N}^a \text{EM P}^a \text{EM P}^a \text{E AME}^a \text{E}^a$

DATA AVAILABILITY

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