




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

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CRYOTRONICS

~ 494 K
 M/μ_B ,
 $B_6F_2C_{18}O_{18}$ (526 K).²³
 BLFC
 $F^{3+} O F^{3+}, C^{3+} O C^{3+}, F^{3+} O C^{3+}$ (.
 ED .²⁴
 A FC ~ 353 K
 $C_2F_4O_4$ ~ 2
 $C_2F_4O_4$ (460 K) $\sim 16,25$
 (M) $C_2F_4O_4$ 1.4 .%
 $16.235 / .$ ²⁵ , 0.22 0.32 / ,
 $C_2F_4O_4$ BLFC
 $M = 1.85 / , F . 2(1.1$
 $M H$
 $\sim 2 (F . 3) .$
 425 K 1.58 / .
 $0.27 / ,$
 ED
 $BLFC$
 A
 $F 3$
 (DF) $F^{3+} O C^{3+}$ *ab initio*
 (A) H
 $\mu_F = 2$ $\mu_C = 3$ $F C$,
 $(GGA)+\mu$. I
 $BLFC$
 $F . 3(1, F^{3+} C^{3+} (3.1 2.1 \mu_B/ ,)$
 O
 $(0.1 \mu_B/) .$
 $F O_6 C O_6$
 $()$ F/C -
 F O / $F . 3(1.1$
 $F^{3+} C^{3+}$ -
 $(. ,)$ $(. ,)$ -
 $E_{FM} - E_{AFM}$
 $= -144.1$.
 H , (FM)
 43.5 (. . , 504.6 K), FM -
 ~ 1 FC/FC $. F . 2(1.1$
 $a b$
 010
 $BLFC$ $F 4$. I
 399 O .
 $F .$
 $F -$

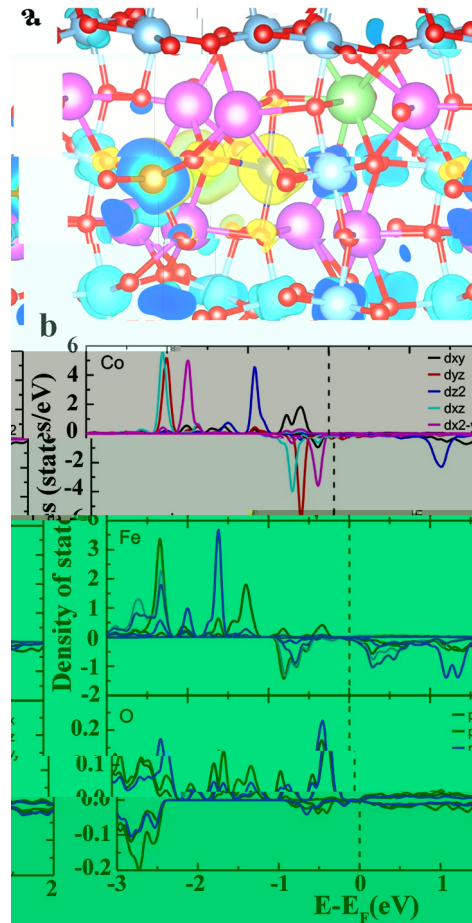


FIG. 3. (a) Crystal structure of BLFC showing Co, Fe, and O atoms. (b) Density of states (DOS) for Co, Fe, and O atoms, showing contributions from dxy, dyz, dz2, dxz, and dx2-y2 orbitals.

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 $0.27 / ,$
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 A
 $F 3$
 (DF) $F^{3+} O C^{3+}$ *ab initio*
 (A) H
 $\mu_F = 2$ $\mu_C = 3$ $F C$,
 $(GGA)+\mu$. I
 $BLFC$
 $F . 3(1, F^{3+} C^{3+} (3.1 2.1 \mu_B/ ,)$
 O
 $(0.1 \mu_B/) .$
 $F O_6 C O_6$
 $()$ F/C -
 F O / $F . 3(1.1$
 $F^{3+} C^{3+}$ -
 $(. ,)$ $(. ,)$ -
 $E_{FM} - E_{AFM}$
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 $a b$
 010
 $BLFC$ $F 4$. I
 399 O .
 $F .$
 $F -$

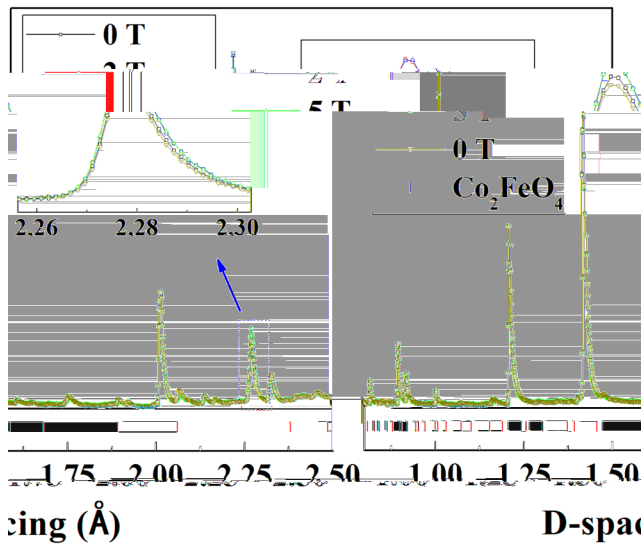


FIG. 4. XRD patterns of Co_2FeO_4 at 0 T and 5 T. The inset shows a magnified view of the 2.26–2.30 Å region. A blue arrow indicates the shift of the peak at 2.28 Å.

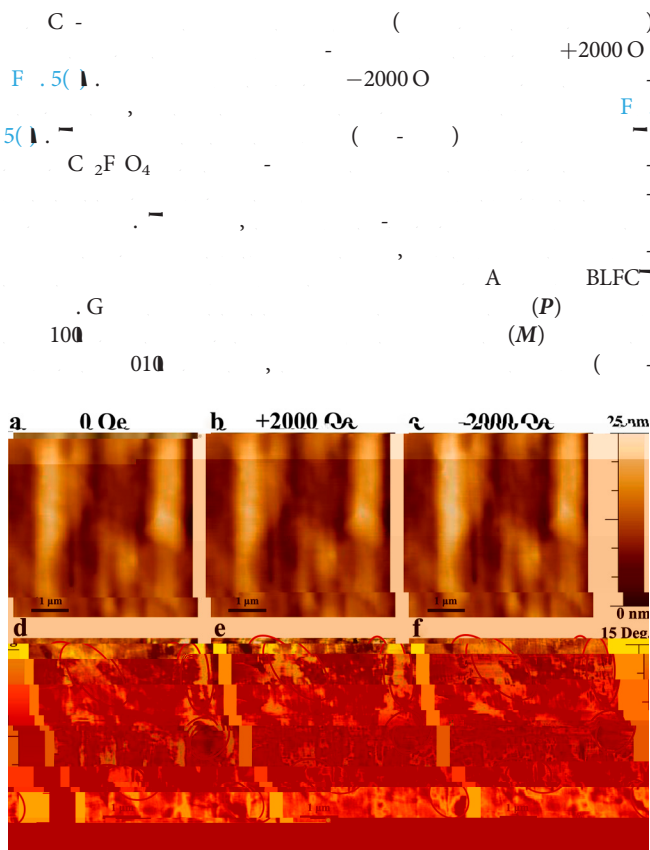


FIG. 5. MFM images of BLFC at different magnetic fields: (a) 0 Oe, (b) +2000 Oe, (c) -2000 Oe. The top row shows 25 nm scale images, and the bottom row shows 15 nm scale images. Labels 'G' and 'A' are present in the 0 Oe image.

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

DATA AVAILABILITY

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