Applied Physics Letters

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

Cite as: Appl. Phys. Lett. **117**, 052903 (2020); https://doi.org/10.1063/5.0017781
Submitted: 09 June 2020 . Accepted: 25 July 2020 . Published Online: 07 August 2020

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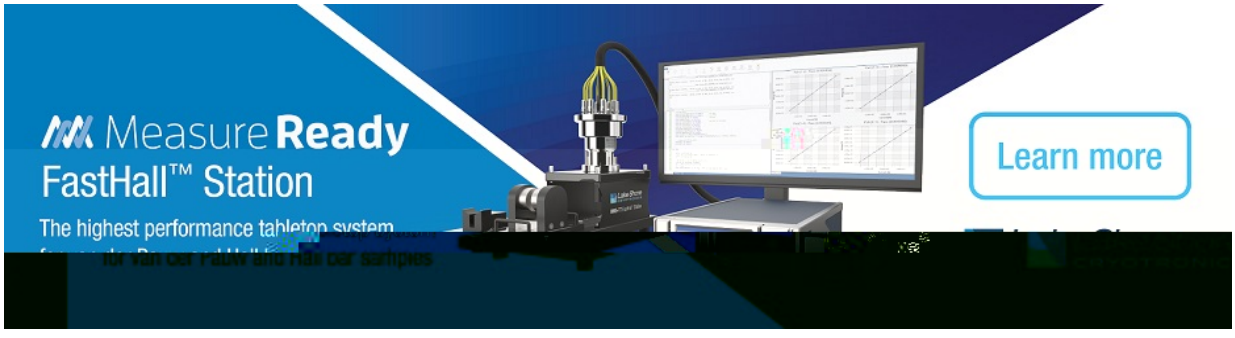

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Published Online: 7 August 2020 · Corrected: 11 August 2020

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ABSTRACT

M a a a a a a a a a a a . H , a - a a a a a a - a a . a , - a A a a a a a a ' a a a a a a D a a a . H , a a A a a B $_{5.25}$L $_{0.75}$F C $_{3}$O$_{18}$ a a a a P a a a a a a a a a a - a a a A a , a *in situ* a a F $^{3+}$ O F $^{3+}$, C $^{3+}$ O C $^{3+}$, a F $^{3+}$ O C $^{3+}$ a - a a a a a . A - a a a , C /F - a a a a a a a a , a a . a .

M a a a (FM) a a a a a a (FE) a a a (FE) a , . [1–4] H a , a - a a , - . [5] a (B $_{2}$O$_{2}$)$^{2+}$(A $_{-1}$B O$_{3}$ $_{+1}$)$^{2-}$ (, B A a A a -, 12- - a a a a)[6] a a B- a a a B F O$_{3}$ a a - a a a a . [7–11] A a a a B $_{5}$F $_{3}$O$_{15}$ (= 4) a B $_{6}$F $_{2}$ $_{3}$O$_{18}$ (= 5), B $_{4}$ $_{3}$O$_{12}$ B F O$_{3}$, a FE a FM . [12,13] B C F B- , B $_{5}$F $_{0.5}$C $_{0.5}$ $_{3}$O$_{15}$ (= 4) a B $_{6}$F C $_{3}$O$_{18}$ (= 5) a a a a a a [14,15] H , a a a a a a a a a a a a D - a . [16] , a a A a

I , A B 5.25 L 0.75 F C 3 O 18 (BLFC) P (P). P L

C , [14,17] D F , A a b , P BLFC a b A

[18]

A , *in situ* I H I I N , AL, D O K. F

( ). A BLFC P

BLFC P .

F 1 (D) BLFC . A *B2cb* A

$A2_1$ A [19,20] *B2cb* $a = 5.4530(2)$ A, $b = 5.4427(1)$ A, $c = 50.670(2)$ A $A2_1am$ $a = 5.4651(6)$ A, $b = 5.3943(6)$ A, $c = 41.487(2)$ A F P (:// . .).

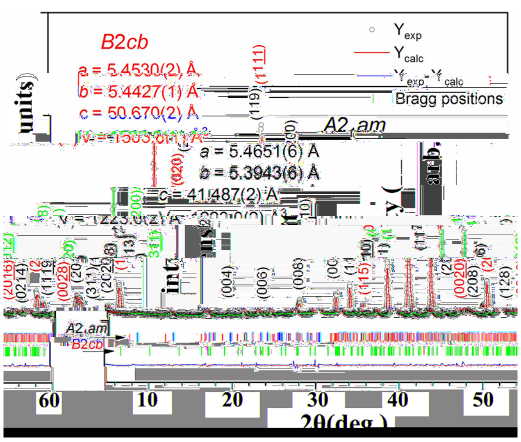

FIG. 1. - B .

BLFC A A = 4 = 5 . N D'

. F 1 EM BLFC . *(a–b*) P . M , F . 1 1.4 %, D. ED (F . 2 1) F , C , O, . , C $_2$F O_4 . A B $_5$F $_{0.5}$C $_{0.5}$ $_3$O$_{15}$.[16] F 2( ) BLFC P (50, 70, 100, 300, 500 H). 1060 K FE *T* BLFC . H BLFC B $_6$ $_3$F $_2$O$_{18}$ (973 K).[13] F 2( ) *P–E* *I–E* BLFC P . *I–E* [21,22] BLFC 10 μC/ ^{2}. F 2( ) (FC) - (FC) 200 O BLFC . BLFC

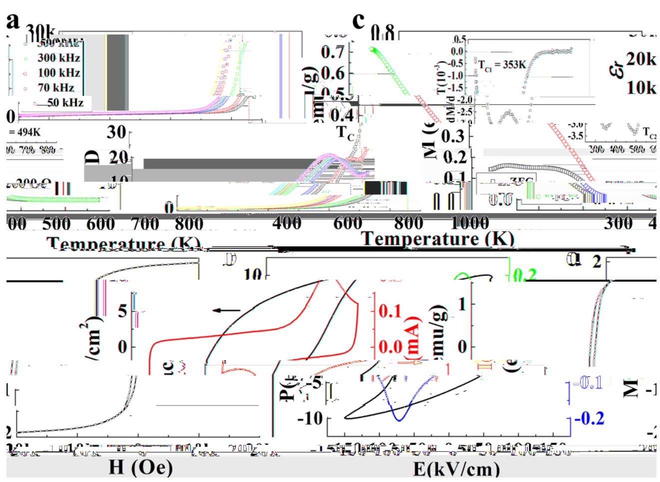

FIG. 2. ( ) ( ) ( ) B ⊥ P . ( ) P B P . ( ) B ⊥ / = 200 . - M/ . ( ) - 300 B .

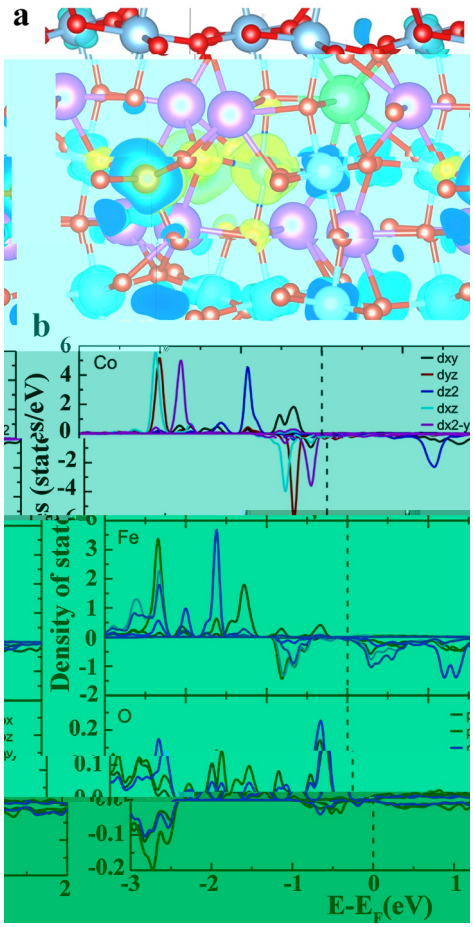

FIG. 3. ( ) (=0.005) ( ),B ( ), ( ), ( ), ( ), ( ) . ( ) A 3+ 3+.

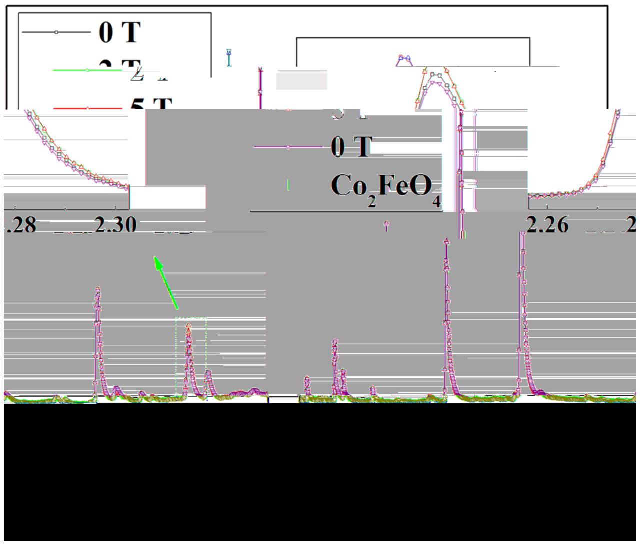

FIG. 4. B (0, 2, 5 0).

C ( ) +2000 O F . 5( ) . −2000 O F . 5( ) . ( ) Co_2FeO_4 P A BLFC . G (P) 100 (M) 010 (

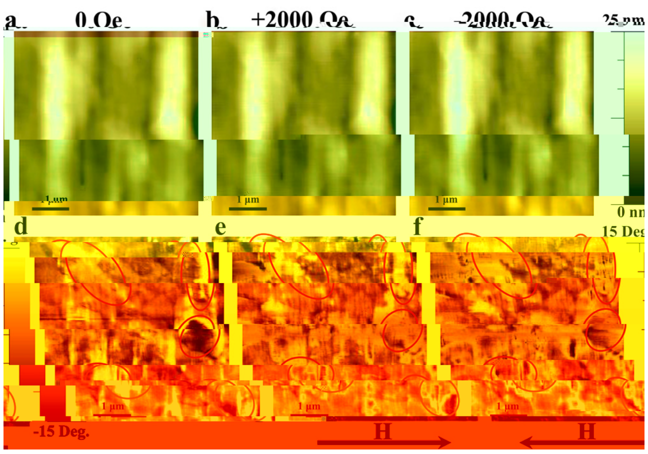

FIG. 5. B ( ). ( ) 0 ( ) ( ) P M +2000 ( ) ( ) P M −2000 .

) $T = P \times M$ BLFC I , A BLFC . F Fe^{3+} O Fe^{3+}, Co^{3+} O Co^{3+}, Fe^{3+} O Co^{3+} . A C /F

EM (ED) BLFC .

D . M , P D . K , D. D I H I I N , AL, D , O , K. A E D F , G A A (G N . 2/ 0038/20), C (G N . K2015-0602006), N FC (G N . 11474138 11834005). A E M P (EM P) P IND54 N . EM P EM P E AME E .

DATA AVAILABILITY

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