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AFFILIATIONS

[1]G l , C f G , 430074, C
[2]I f M , A f , 47, K 04001,
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[5]N L , H , 11 0L , K
[6]E L , F , G 99 , K
[7] f , L , L 730000, C

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ABSTRACT

M . H , - A , D . H , A $B_{5.25}La_{0.75}F C_3O_{18}$ P . A , *in situ* F $^{3+}$ O F $^{3+}$, C $^{3+}$ O C $^{3+}$, F $^{3+}$ O C $^{3+}$ - . - . . A , C /F - , - .

M (FE) A $B_5F_3O_{15}$ (=4) $B_6F_2_3O_{18}$ (FM) (=5), $B_4_3O_{12}$, , BFO_3, FE FM .[12,13] B - , .[1 4] H , - C F B- , $B_5F_{0.5}C_{0.5}_3O_{15}$ (=4) $B_6FC_3O_{18}$ (=5) .[5] , - A $(B_2O_2)^{2+}(A_{-1}B O_{3+1})^{2-}$ (A -, 12- - , B - .[14,15] H , -, D -)[6] .[16] , - B- A BFO_3 - .[7 11] .

I , A a $Bi_{5.25}La_{0.75}Fe_3O_{18}$ (BLFC) a a a P a a (P). Pa a La a a , C , - F , a a a a .[14,17] D a a A a a a a - a a *a b* a , P BLFC a a a a *a b* a a a a a . a A a - a , - a a . [18] a a a a a a - a a a a a - A a , a *in situ* a a I H a I I N a a a , AL, D , O , K. F a a a a - a a a a a a a a a ( ). , a a A BLFC a a a a P a a a a a a a . BLFC a a a a P . a a a a , a - a a , a a a a a a . F 1 - a a (D) a BLFC . A a a a *B2cb* a a a - a A a , a a a a a *A2*$_1$*a* a , a - a A .[19,20] a a a - *B2cb* $a = 5.4530(2)$ A, $b = 5.4427(1)$ A, a $c = 50.670(2)$ A a - a *A2*$_1$*am* a $a = 5.4651(6)$ A, $b = 5.3943(6)$ A, a $c = 41.487(2)$ A a a a F P a a a (:// . .).

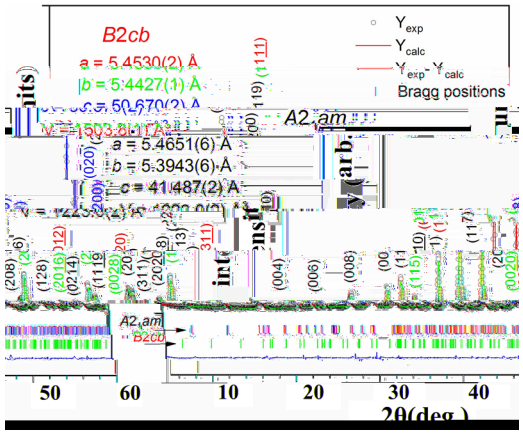

FIG. 1. -a a a e B e .

a a BLFC a - a A a a = 4 a = 5 a . N a a a D' a . F 1 EM a - BLFC a . a - a (*a–b* a) a a P . M , a a a a a a a a F . 1 a . a - a a a a 1.4 . %, a D. ED a a a (F . 2 a a 1) a a a a a F , C , O, a . , a a a C $_2$F O_4 a a a a a a- . a a a a a - a A $B_5F_{0.5}C_{0.5}{}_3O_{15}$.[16] F 2(a) a a BLFC a a a P a (50, 70 100, 300, a 500 H). a a a 1060 K FE *T* BLFC . H , a a BLFC a a $B_6{}_3F_2O_{18}$ a (a 973 K).[13] F 2( ) *P–E* a *I–E* BLFC a a a a P a . a *I–E* a ,[21,22] a a . a a a a BLFC 10 μC/ ^{2}. F 2( ) a - (FC) a - (FC) a a a a a 200 O BLFC . a BLFC

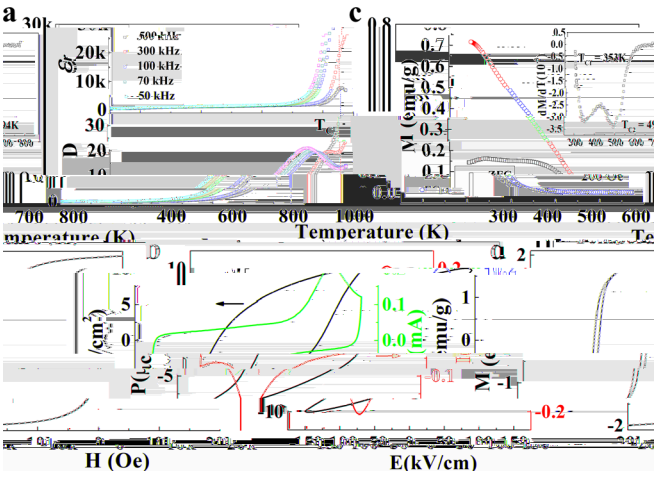

FIG. 2. (a) e e ea ue e e e e ea e ee e (a e)a a e ( ) B ea ea ue e e ua ⊥ e P e ue e .( ) e P a ee e e ue B ea ea ue e e ua e P e ue e . e u e ae e a a a e a e ee .( ) e e ea ue e e e e e a e za B ea ⊥ e Z / e ea ue =200 e. e e e e a e a e- za / a a u e ea ue.( ) e e e e e e a e za- a 300 e B a e.

$_1 \sim 494$ K (M/), B $_6$F C $_3$O$_{18}$ (526 K).[23] BLFC F $^{3+}$ O F $^{3+}$, C $^{3+}$ O C $^{3+}$, F $^{3+}$ O C $^{3+}$ (.).[24] - ED . A FC $_2 \sim 353$ K C $_2$F O$_4$. $_2$ - C $_2$F O$_4$ (460 K) .[16,25] (M) C $_2$F O$_4$ 16 23.5 / .[25] , 1.4 . % C $_2$ F O$_4$ 0.22 0.32 / , BLFC M = 1.85 / , F . 2( ) . I - , M H - $_1$ $_2$ (F . 3). - 425 K 1.58 / . 0.27 / , ED . , BLFC A . F 3 F $^{3+}$ O C $^{3+}$ - (DF) *ab initio* (A P) . H $_F = 2$ $_C = 3$ F C , , - (GGA)[+] . I - BLFC F . 3(a) , F $^{3+}$ C $^{3+}$ (3.1 2.1 μ_B/ ,), O (0.1 μ_B/). - F O$_6$ C O$_6$ ( ) F /C - F O - / . F . 3( ) . F , - F $^{3+}$ C $^{3+}$, (.,) (., -) , . - , $E_{FM} - E_{AFM} = -144.1$. H ' . (FM) 43.5 (., 504.6 K), FM - $_1$ FC/FC . F . 2( ) . *a b* . - 010 . F 4 BLFC . I - , - , - .

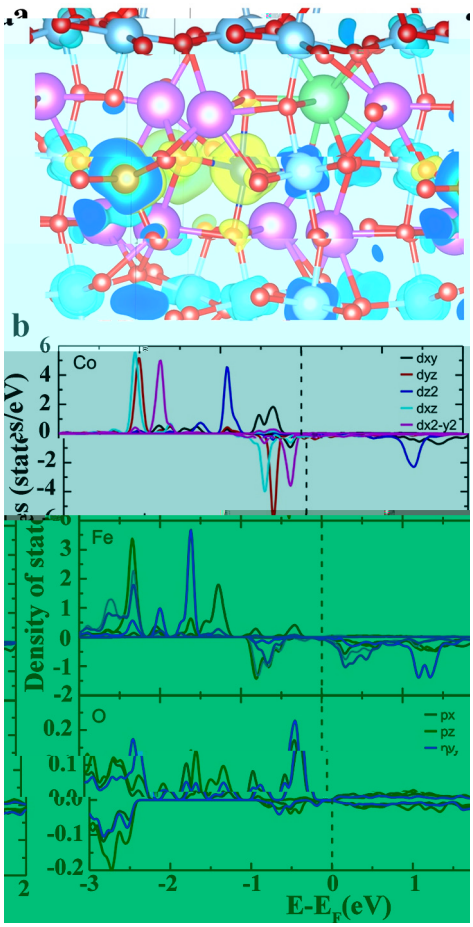

FIG. 3. ( ) e e (ua e e e = 0.005) (e), B ( ), a (ee), (ue), (a ue), a e (e) a . ( ) A e a e e e ae e $^{3+}$ $^{3+}$.

. . N , , , . I F . 4, A (0 1 20) , 2 . F (2 < H < 5), , 2 , M H F . 2( ) 3. F , - F O - / . F . 3( ) . F , - F $^{3+}$ C $^{3+}$, (.,) (., -) , . - , $E_{FM} - E_{AFM} = -144.1$. H ' . (FM) 43.5 (., 504.6 K), FM - $_1$ FC/FC . F . 2( ) . *a b* . - 010 . F 4 BLFC . I - , - , - . F 5 BLFC P F M 399 O . PFM BLFC , F . 5( ). A F -

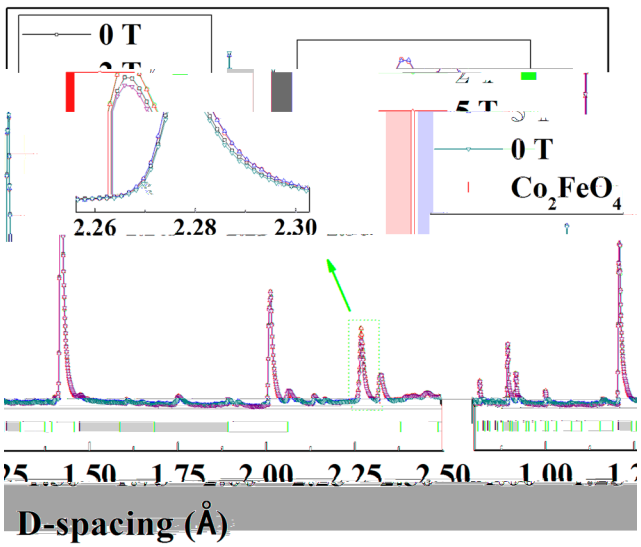

FIG. 4. e e ea ue eu a ae ae e B ea a ee a e e (0, 2,a 5 a e a 0).

a C - a (a) a a a a - a a +2000 O F . 5( ) . a a −2000 O a - , a a F . 5( ) . (- a) a a C 2F O4 a - a a - a a . , a - a , a - P a A BLFC a . G a a a (P) a 100 a a (M) a a 010 , a a (-

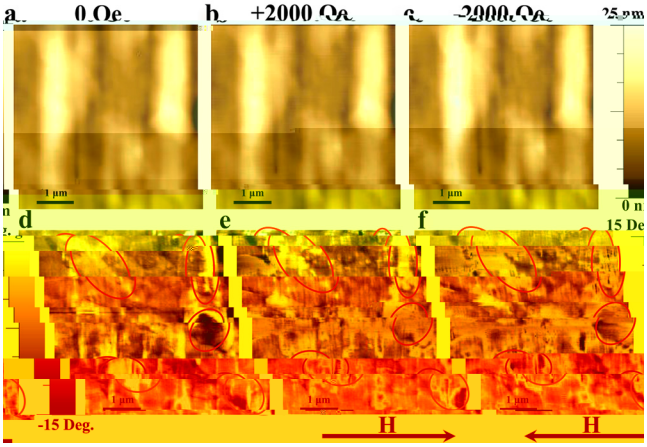

FIG. 5. e ee a B ue ea e a e e (aae e uae e a e). (a) a a ( ) e a P aea 0 e ( ) a a (e) e a P aea +2000 e a ( ) a a ( ) e a P aea −2000 e.

) a $T = P \times M$ a a a a BLFC a . I , A a BLFC a a a a a a a a - a . F a 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 . a a a , a a EM - a (ED) , a a a BLFC a .

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

DATA AVAILABILITY

a a a a a a a a a a a a a.

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