Supplemental Materials

Reentrant spin reorientation transition and Griffiths - like phase in antiferromagnetic $TbFe_{0.5}Cr_{0.5}O_3$

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Neutron powder diffraction (NPD) Analysis

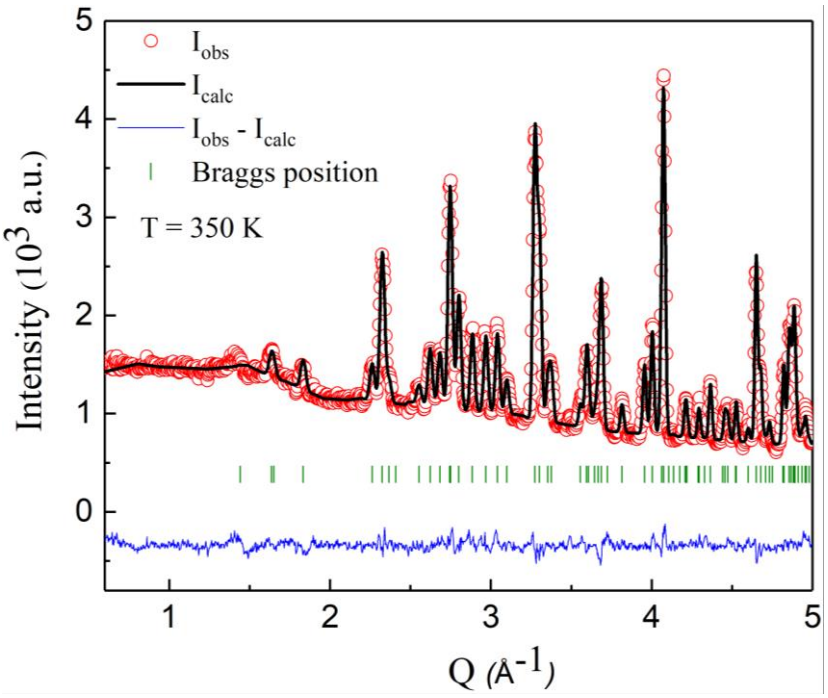

FIG. S1. Rietveld refinement of neutron powder diffraction data at 350 K with Pnma space group. The intensity of nuclear Bragg peak position at (101) is not fully accounted for by the model.

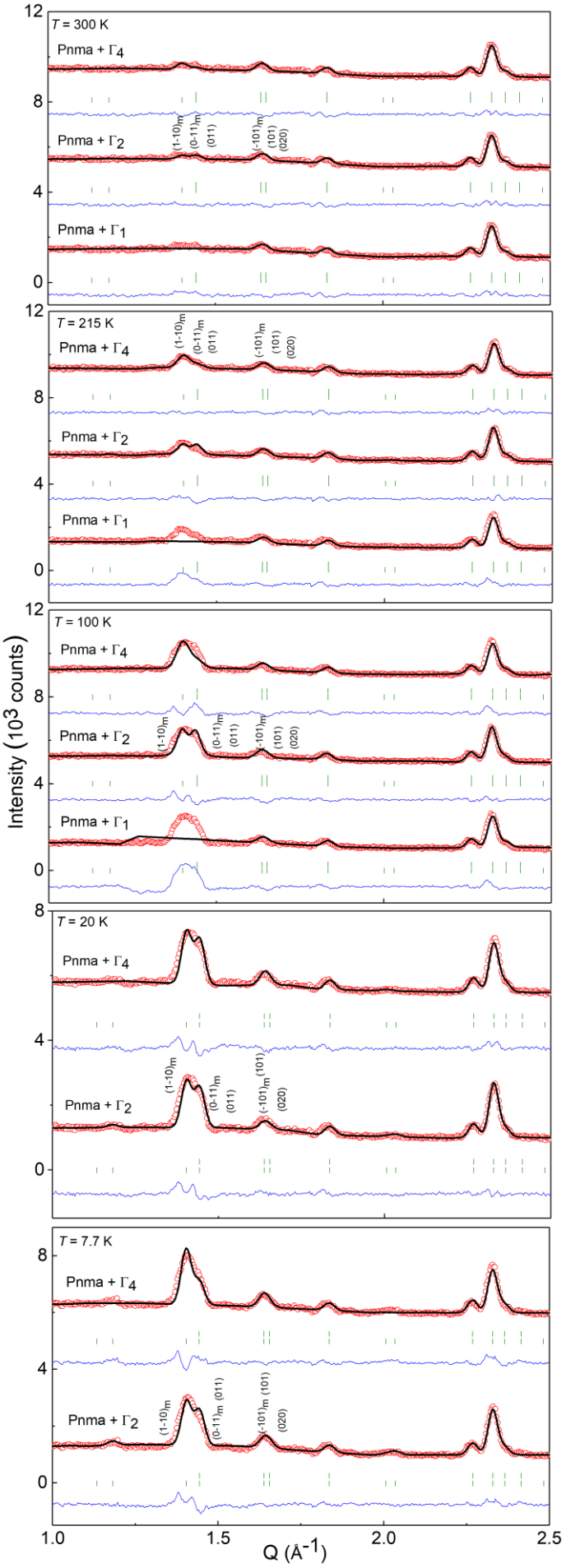
T = 300 K
Pnma + Γ4
Pnma + Γ2
Pnma + Γ1
T = 215 K
T = 100 K
T = 20 K
T = 7.7 K
(1-10)m
(0-11)m
(011)
(-101)m
(101)
(020)
Intensity (10^3 counts)
Q (Å^-1)
1.0
1.5
2.0
2.5
0
4
8
12

FIG. S2. Neutron powder diffraction pattern of $TbFe_{0.5}Cr_{0.5}O_3$. The experimental data (red) and calculated pattern (black) with the Rietveld refinement program at 300 K, 215 K, 100 K, 20 K and 7.7 K for all possible irreducible representations confirms that the magnetic structure of $TbFe_{0.5}Cr_{0.5}O_3$ belongs to Γ2 representation at 300 K, at T_N (257 K) it transforms to Γ4, and at T_{SR} (190 K) it re-enters Γ2 which remains stable down to 7.7 K.

T (K)	**Element**	**m_x (μ_B)**	**m_y (μ_B)**	**m_z (μ_B)**
300	Fe^{3+}/Cr^{3+}	0.52(4)	3.58(1)	0.62(1)
215	Fe^{3+}/Cr^{3+}	0.48(6)	0.59(2)	1.74(3)
100	Fe^{3+}/Cr^{3+}	0.52(4)	3.48(2)	1.38(5)
20	Fe^{3+}/Cr^{3+} Tb^{3+}	0.11(4) 0.88(1)	3.14(4) 0.00	0.75(2) 0.84(6)
7.7	Fe^{3+}/Cr^{3+} Tb^{3+}	0.13(1) 1.14(2)	3.19 (4) 0.00	1.27(1) 0.00

Table. S1. Components of magnetic moment obtained from neutron powder diffraction for $TbFe_{0.5}Cr_{0.5}O_3$ at different temperatures.