Contribution ID : **58** Type : **not specified**

An investigation of magnetic structure and spin reorientation in Cr and Mn doped rare earth ferrites using neutron powder diffraction

Thursday, 4 February 2016 12:15 (15)

Rare earth orthoferrite RFeO3 is a family of perovskite with fantastic property, such as ultra-fast spin switching[1], photomagnetic excitation[2]and multiferrocity[3]. These properties usually determined by their magnetic structure and unique spin reorientation(SR) effect. The antisymmetric interaction(DM interaction)[4] induce a weak ferromagnetism at room temperature, while the large anisotropic interaction of R3+ ion induce a rotation of Fe3+ spin in the ac or ab plane, viz. spin reorientation. Usually there are 3 types magnetic structure for orthoferrite, in terms of Bertaut's notation[5], $\Gamma_4(G_xA_yFz)$, $\Gamma_2(F_xC_yG_z)$ and $\Gamma_1(A_xG_yC_z)$. For most of magnetic R^{3+}, there is $\Gamma_4(G_xA_yF_z) \rightarrow \Gamma_2(F_xC_yG_z)$ transition except $R^{3+} = Dy^{3+}$ upon cooling[6], which show a $\Gamma_4 \rightarrow \Gamma_1$. We investigated the magnetic structure and SR transition of Cr doped $HoFeO_3$ and Mn-doped $TbFeO_3$ using neutron powder diffraction. We found Cr substitution for Fe leads to an increasing SR transition temperature of $\Gamma_4 \rightarrow \Gamma_2$ dramatically. On the other side, the Mn substitution of Fe in $TbFeO_3$ vanishes the $\Gamma_4 \rightarrow \Gamma_2$ transition while induces a novel $\Gamma_4 \rightarrow \Gamma_1 \rightarrow \Gamma_4$ transition. This is unusual because it is usually think it is the the anisotropic rare earth ion determines the SR property. Our observation demonstrate a delicate balance of magnetic interaction in system. This will provide us new interesting physics and potential functional materials.

References

[1] A. V. Kimel, B. A. Ivanov, R. V. Pisarev, P. A. Usachev,A. Kirilyuk, and T. Rasing, Nat. Phys.5, 727(2009).

[2]J. A. de Jong, A. V. Kimel, R. V. Pisarev, A. Kirilyuk, and T. Rasing, Phys. Rev. B 84, 104421(2011).

[3]Y. Tokunaga, S. Iguchi,T. Arima and Y. Tokura, Phys.Rev.Lett.101,097205 (2008)

[4]I. Dzyaloshinskii, J. Phys. Chem. Solids 4, 241 (1958); T. Moriya, Phys. Rev. 120, 91 (1960).

[5]E. F. Bertaut, Magnetism, edited by G. T. Rado and H. Suhl (Academic, New York, 1963), Vol. 3, p. 149.

[6]R. L. White, J. Appl. Phys. 40, 1061(1969)

Primary author(s) : Dr LIU, Xinzhi (China Institute of Atomic Energies, Beijing, 102413, China/Bragg institute, ANSTO, 2232, NSW)

Co-author(s) : Ms FANG, Yifei (Department of Physics, Shanghai University, Shanghai 200444, China)

Presenter(s) : Dr LIU, Xinzhi (China Institute of Atomic Energies, Beijing, 102413, China/Bragg institute, ANSTO, 2232, NSW)

Session Classification : Contributed talk