Accepted Manuscript

Coexistence of weak ferromagnetism with magnetoelectric coupling in Fe substituted $Co_4Nb_2O_9$

C. Dhanasekhar, S.K. Mishra, R. Rawat, A.K. Das, A. Venimadhav

PII: S0925-8388(17)32710-X

DOI: 10.1016/j.jallcom.2017.07.323

Reference: JALCOM 42739

To appear in: *Journal of Alloys and Compounds*

Received Date: 16 May 2017

Revised Date: 28 July 2017

Accepted Date: 29 July 2017

Please cite this article as: C. Dhanasekhar, S.K. Mishra, R. Rawat, A.K. Das, A. Venimadhav, Coexistence of weak ferromagnetism with magnetoelectric coupling in Fe substituted $Co_4Nb_2O_9$, *Journal of Alloys and Compounds* (2017), doi: 10.1016/j.jallcom.2017.07.323.

Coexistence of weak ferromagnetism with magnetoelectric coupling in Fe substituted $Co_4Nb_2O_9$

C. Dhanasekhar[1, 3], S. K. Mishra[2], R. Rawat[2], A. K. Das[1] and A. Venimadhav[3*]

[1]*Department of physics, Indian Institute of Technology, Kharagpur -721302, India*

[2]*UGC-DAE Consortium for Scientific Research, Khandwa Road, Indore, 452017, Madhya Pradesh, India*

[3]*Cryogenic Engineering Centre, Indian Institute of Technology, Kharagpur -721302, India*

Abstract

$Co_4Nb_2O_9$ (CNO) having Co chains along c-direction shows gigantic magnetoelelctric coupling below antiferromagnetic ordering temperature of 27.3 K but above a spin flop field of 1.6 T. We have investigated the effect of substitution of 20% of isovalent magnetic Fe^{2+} onmagnetic and magnetoelectric properties. With Fe substitution, magnetization with temperature has shown a weak ferromagnetic behavior at low magnetic fields and antiferromagnetic likebehavior at higher fields. Interestingly, linear magnetoelelctric and ferroelectric behaviors are evidenced in the Fe substituted samples but for an electric field as small as 5 kV/m and the magnetoelelctric coupling is ensured for magnetic fields as low as 0.25 T, which is far below the spin flop field. The reduction in single ion anisotropy of Co and modified Dzyaloshinkii-Moriya interactions with Fe appear to be important in inducing low field ME effect.

Key words: magnetoelectric, multiferroic, antiferromagnetic