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Coexistence of weak ferromagnetism with magnetoelectric coupling in Fe substituted $\text{Co}_4\text{Nb}_2\text{O}_9$

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Abstract

$\text{Co}_4\text{Nb}_2\text{O}_9$ (CNO) having Co chains along c-direction shows gigantic magnetoelectric 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+} on magnetic and magnetoelectric properties. With Fe substitution, magnetization with temperature has shown a weak ferromagnetic behavior at low magnetic fields and antiferromagnetic like behavior at higher fields. Interestingly, linear magnetoelectric and ferroelectric behaviors are evidenced in the Fe substituted samples but for an electric field as small as 5 kV/m and the magnetoelectric 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 Dzyaloshinskii-Moriya interactions with Fe appear to be important in inducing low field ME effect.

Key words: magnetoelectric, multiferroic, antiferromagnetic

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