Magnetoelectric property in 3d transition metal oxide with tetrahedral structure

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Recently, spin-driven electric polarization is reported in a staggered antiferromagnet $Ba_2CoGe_2O_7$ with CoO_4 tetrahedra. The mechanism of the electric polarization can be explained by the spin-dependent p-d hybridization model. In this work, in order to explore novel multiferroic materials, we have investigated magnetic and dielectric anisotropies of $CaBaCo_4O_7$ single crystal, which has layered structure consisting of CoO_4 tetrahedra. The crystallographic symmetry of $CaBaCo_4O_7$ is $Pbn2_1$ at room temperature, which breaks the inversion symmetry. The magnetic moments along the a- and b-axes rise at 64 K, suggesting a weak ferromagnetism. We have also observed an increase of electric polarizations along the b- and c-axes at the magnetic transition temperature. In addition, the peaks of dielectric constant along the b- and c-axes also emerge at the same temperature. When applying a magnetic field of 8 T along the parallel direction to the electric polarization, the rise of electric polarization shifts toward higher temperatures by 8 K. While in the case of the perpendicular direction, that shifts by 15 K. These results may suggest that the electric polarization is closely related to the induced magnetization. We will discuss the detailed results of experiments that include the poling electric- and magnetic-field dependence of electric polarization.