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Magnetization reversal in $Bi_5Ti_3Co_{0.5}Fe_{0.5}O_{15}$ ceramics

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Abstract:

Here we report the structural, magnetic and dielectric properties of polycrystalline $Bi_5Ti_3Co_{0.5}Fe_{0.5}O_{15}$ ceramic compounds. The samples annealed at 1073, 1173, and 1273 K were prepared by a modified Pechini process. XRD patterns of the samples show a single phase with a four-layered Aurivillius structure. The XPS analysis reveals that the oxygen vacancies increase with the sintering temperature. Temperature-induced magnetization reversal is observed around 133 and 127 K in a field-cooled mode with an applied field of 50 Oe in the samples sintered at 1173 and 1273 K, respectively. We identify that the magnetization reversal in these oxides originates from the competition between single-ion magnetic anisotropy and antisymmetric Dzyaloshinsky-Moriya interaction. In addition, we have also observed that the dielectric constant and loss tangent are enhanced by increasing sintering temperature. Both the appearance of magnetic reversal and the rising dielectric loss tangent are induced by the intensified distortion of the lattice structure due to the increment of oxygen vacancies as the increase in the sintering temperature.

Keywords: magnetization reversal; negative magnetization; Aurivillius structure; single-ion magnetic anisotropy; antisymmetric Dzyaloshinsky-Moriya interaction; dielectric properties.

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