Origin of the multiferroic-like properties of \( \text{Er}_2\text{CoMnO}_6 \)

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**Experimental section.**
- \( \text{Er}_2\text{CoMnO}_6 \) was prepared by solid state reaction of \( \text{Er}_2\text{O}_3 \), \( \text{Mn}_2\text{O}_3 \) and \( \text{CoO} \) in air at 1250°C followed by a very slow cooling (0.1°C/min) in order to improve the \( \text{CoMnO}_6 \) ordering. \( \text{X}-\text{ray} \) patterns agree with a single phase.
- Neutron powder diffraction measurements were performed at the ILL, using the high intensity D1B (\( \theta=2.52 \AA \)) and high resolution D2B (\( \theta=1.59 \AA \)) diffractometers between 1.75 and 295 K.
- Reversal of the patterns were carried out using the Fullprof program. The refinement at 295 K (paramagnetic phase) agrees with a double perovskite structure with a monoclinic distortion (\( \Pi_2/\text{m} \) space group). The antiferroelectric phases were achieved by applying a sinusoidal field at 1.5K.

**Results.**
- The dielectric constant \( \varepsilon' \) (a) exhibits a step-like increase from a low-temperature value of \( \sim 10^5 \) to a high value of \( \sim 10^9 \) at 300 K.
- The dielectric loss \( \tan \delta \) (b) shows a peak at 2 K that can be attributed to a ferroelectric-like transition.
- Neutron inelastic scattering data were performed on the sample at \( 10 \) and \( 10^2 \) Hz. The \( \Delta Q \) plots show peaks for the magnetic structure.
- The dielectric permittivity \( \varepsilon' \) (c) exhibits a step-like increase from a low-temperature value of \( \sim 10^5 \) to a high value of \( \sim 10^9 \) at 300 K. The dielectric loss \( \tan \delta \) (d) shows a peak at 2 K that can be attributed to a ferroelectric-like transition.

**Conclusions.**
- The magnetic anisotropy comes from the ferromagnetic ordering of \( \text{CoMnO}_6 \) sublattice due to the ferromagnetic Co\( ^{2+} \)-Mn\( ^{3+} \) superexchange interaction.
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**References:**