Room temperature magnetoelectric coupling in a molecular ferroelectric ytterbium(III) complex

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Magneto-electrical (ME) materials combine magnetic and electric polarizabilities in the same phase. Such systems offer a basis for developing high-density data storage, spintronic or low consumption devices owing to the possibility to trigger one property by the other. Such objectives require a strong interaction between the constitutive properties, a criteria which is rarely met in classical inorganic ME materials at room temperature. We have demonstrated room temperature magnetoelectric control of ferroelectric domains in a molecule-based material [1], Fig. 1. Thus, in the Yb^{3+}-based chiral compound R,R-1, the combination of ferroelectric behavior with a magnetostrictive effect generates a strong ME coupling observed at room temperature and with a relatively low magnetic field. These properties are useful for practical device application including non-volatile memory where information would be stored as electrically detectable and controllable by Yb^{3+} paramagnetism. More generally, such features appear particularly unique in single-phase materials and confirm that the genuine chemical design of multifunctional molecular materials may provide an alternative strategy to usual solid-state compounds for engineering ME devices.

[1] Long et al., Science 367, 671–676 (2020) 7. 10.1126/science.aaz2795

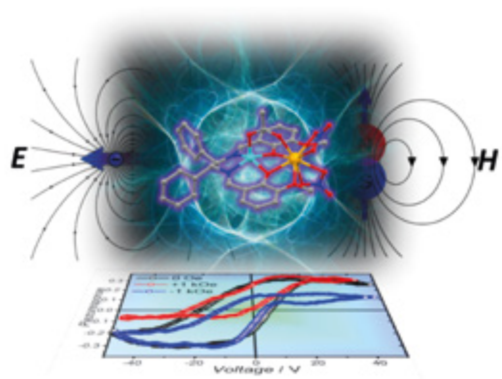

FIGURE 1
Molecular structure of the dinuclear Zn^{2+}-Yb^{3+} complex [1] in the presence of an applied electrical (E) and magnetic (H) fields. (bottom) Switching spectroscopy force microscopy (SS-PFM) hysteresis loops obtained at zero and under applied magnetic field of ±1 kOe.