Ferroelectric Spin-Peierls Transition in the Organic Charge Transfer Salt TTF-BA

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Since the discovery of Rochelle salt, ferroelectricity has been an important issue in condensed-matter physics. Ferroelectrics of current interest are magnetically controllable ones [1], and the magnetic-order-induced ferroelectrics —so-called "multiferroics"— are one of the promising candidates. In this presentation, we report a new class of magnetically controllable ferroelectrics, that is, ferroelectricity induced by the spin-Peierls (SP) transition. The first example was found in the organic charge-transfer salt TTF-BA (tetrathiafulvalene-*p*-bromanil), in which a polar stack is realized through the dimer-singlet formation of the ionic TTF donor (D^+) and BA acceptor (A^-) molecules [Figs. 1(a) and (b)]. The ferroelectric SP phase was suppressed by a magnetic field, i.e., the present ferroelectricity is found to be magnetically controllable: this is also the first example in the field of organic ferroelectrics. Quantitative analysis of the magnetic field effect revealed that the ferroelectric SP phase is robust compared with the universal behavior of SP systems [2, 3], suggesting that the ferroelectric SP phase is induced by not merely SP instability but also ferroelectric instability.

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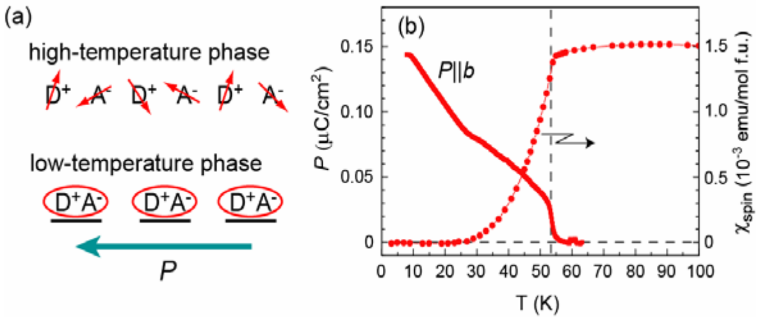

Fig. 1 (a) Schematic structure of ionic donor (D^+) and acceptor (A^-) mixed stack in high- and low-temperature phases of TTF-BA. (b) Temperature dependence of electric polarization along the b axis and spin susceptibility.