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Structure and physical properties of ferromagnetic crystals with supramolecular cations

Kazuya Kubo¹, Toru Endo¹, Masashi Yoshitake¹, Shin-ichiro Noro¹, Norihisa Hoshino², Tomoyuki Akutagawa² and Takayoshi Nakamura¹

¹Hokkaido University, Japan

²Tohoku University, Japan

A crystal of dithiolene complex with supramolecular cation, (*m*-fluoroanilinium⁺) (dibenzo[18]crown-6)[Ni(dmit)₂] exhibiting ferroelectric transition at 346 K originating from dipole inversion due to flip-flop motion of the aryl moiety in the supramolecular cation have been reported. The supramolecular cations are advantageous for the development of the multifunctional materials based on ferroelectrics by combining with various functional anions. In this study, (3-fluoro-4-methoxyanilinium⁺)([18]crown-6)[Mn^{II}Cr^{III}(oxalate)₃]⁻, (anilinium⁺)(benzo[18]crown)[Mn^{II}Cr^{III}(oxalate)₃]⁻, and (*m*-fluoroanilinium⁺)(dicyclohexano[18]crown-6)[Mn^{II}Cr^{III}(oxalate)₃]⁻ were synthesized in order to develop multiferroic materials coexisting a ferromagnetism and a ferroelectricity. The crystal 1 had a structure (monoclinic, *Cc*) with the two-dimensional honeycomb structure of [Mn^{II}Cr^{III}(oxalate)₃]⁻. Supramolecular cation was formed between 3-fluoro-4-methoxyanilinium⁺ and [18] crown-6 through hydrogen bonds. Alternate stackings of the cationic and anionic layers were found along the *c* axis. Similar packing motives were observed in the crystals 2 and 3 with the space groups of monoclinic, *P2*₁ and orthorhombic *P2*₁*2*₁*2*₁, respectively. The [Mn^{II}Cr^{III}(oxalate)₃]⁻ had the two-dimensional honeycomb structures and the supramolecular cations, (anilinium⁺)(B[18]crown) and (*m*-fluoroanilinium⁺)(DCH[18]crown-6) were also formed in the chiral structures. All crystals exhibited ferromagnetic orders between S=5/2 on Mn^{II} and S=3/2 Cr^{III} ions. AC magnetic susceptibility measurements revealed the ferromagnetic transition temperature of 5.5 K for all crystals.

Biography

Kazuya Kubo has completed his PhD at the age of 29 years from Osaka University and became a postdoctoral researcher at RIKEN. He is an Assistant Professor, Research Institute for Electronic Research, Hokkaido University. He has published more than 40 papers in reputed journals.

kkubo@es.hokudai.ac.jp