Photoluminescence Properties of a Three-Dimensional Coordination Polymer from Rare Earth Ion and Small Ligands

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Polymeric structures are expected to exhibit interesting physical properties due to accumulation of metal ions. Rare earth ions and multiple carbonyl ligands provide multinuclear complexes. We synthesized polymeric polynuclear coordination structures from oxalate (ox), carbonate, and europium(III) ions as $[Eu_2(ox)(CO_3)_2(H_2O)_2]_n$ which synthesized by means of hydrothermal synthesis under acidic conditions[1)]. This compound shows pink luminescence in spite of the presence of aqua ligands.

As the X-ray single crystal structure analysis revealed, the complex formed a three-dimensional "pillared-layer" structure (Fig. 1). Europium(III) and carbonate ions configure a layer parallel to the *ac* face and ox^{2-} ions work as a pillar. Every europium(III) ion has 9 coordination oxygen atoms, 2 of which are from ox^{2-}, 6 from CO_3^{2-}, and 1 from an aqua ligand. The emission spectrum (Fig. 2) shows specific peaks from europium(III) ion. Antenna effect does not work, because the absorption bands in the excitation spectrum would be attributed directly to the excitation of europium(III). The quantum yield of this compound was found to be 10.6% at 400 nm excitation. The excited state of the present europium(III) derivative has a longer life time than that of the known europium(III) oxalate pentahydrate[2)]. It may be related to the reduced number of the water molecules incorporated.

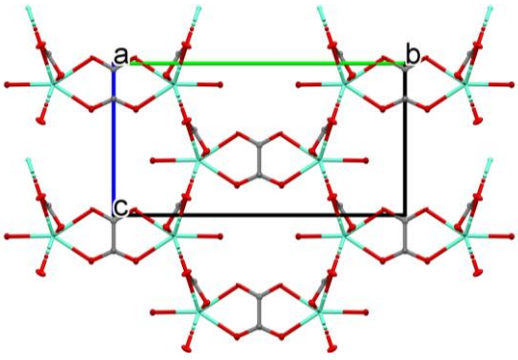

Fig. 1. The crystal structures of $[Eu_2(ox)(CO_3)_2(H_2O)_2]_n$ viewed along the *a* axis.

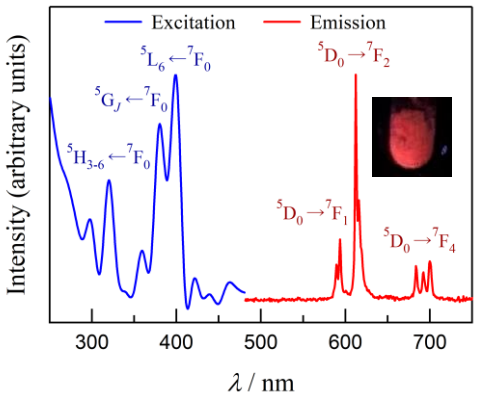

Fig. 2. Excitation and emission spectra.

Ref. 1) R. Takano et al., *CrystEngComm*. **2022**, *24*, 7786.
2) D. Alexander et al., *Acta Crystallogr. Sect. C: Struct. Chem*., **2019**, *75*, 589.