Highly Efficient Emission of Eu(III) Complex Doped Host-Guest Films by Triplet Sensitization

([1]*Department of Chemistry, Kyushu University*, [2]*Graduate School of Chemical Sciences and Engineering, Hokkaido University,* [3]*Faculty of Engineering, Hokkaido University,* [4]*WPI-ICReDD, Hokkaido University,* [5]*OPERA, Kyushu University*) ○Shiori Miyazaki,[1] Kiyoshi Miyata,[1] Pedro Paulo Ferreira da Rosa,[2] Fumiya Suzue,[2] Yuichi Kitagawa,[3,4] Kenichi Goushi,[5] Chihaya Adachi,[5] Yasuchika Hasegawa,[3,4] Ken Onda[1]

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Trivalent europium (Eu(III)) complexes are expected to be used as electroluminescence devices because of their high color purity emission[1]. The complexes utilize intramolecular energy transfer from ligands to a metal center. In an emitting layer of EL devices, guest molecules are doped in host molecules, and energy transfer occurs between guest molecules and host molecules. To date, the emission mechanism is unclear, and the design strategies of the complex have not been established. To elucidate the emission mechanism in host-guest films, we investigated the Eu(III)-complex-doped host-guest films using time-resolved photoluminescence spectroscopy (TR-PL) and transient absorption spectroscopy (TAS).

The 10 wt% $Eu(hfa)_3(TPPO)_2$ (hfa: hexafluoroacetylacetonate, TPPO: triphenylphosphineoxide) (Figure 1a) doped host-guest films were fabricated. We discovered that the photoluminescent quantum yield (PLQY) of the host-guest film depends on a choice of host molecule. Here, we focus on the most luminescent host-guest film which employed T2T (T2T: 2,4,6-tris(biphenyl-3-yl)-1,3,5-triazine) (Figure 1b) as the host molecule. The PLQY of this film (80%) is higher than those of solutions (59%)[2]. By measuring its excitation spectra, we discovered the intermolecular energy transfer from T2T to Eu(III) complex. To elucidate the emission mechanism in detail, we tracked the energy transfer processes of the various host-guest films after T2T excitation. By TR-PL and TAS measurements, we found quick and high quantum yield intersystem crossing of T2T. After the intersystem crossing, efficient energy transfer occurs from the T_1 state of the T2T to the T_1 state of ligands (Figure 2). The energy transfer mechanism we revealed here is able to sensitize the highly efficient luminescence of the Eu(III).

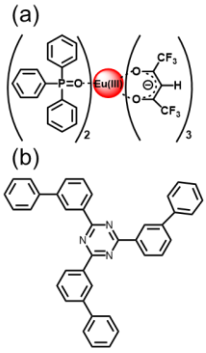

Figure 1. chemical structures (a) $Eu(hfa)_3(TPPO)_2$ (b) T2T.

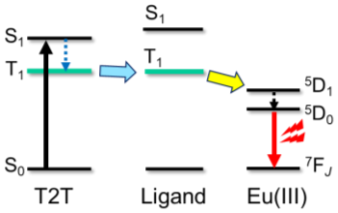

Figure 2. Energy transfer mechanism in the host-guest film.

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