Circularly polarized luminescence of chiral Eu(III) complexes with phenanthrene unit

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Keywords: Europium, Circularly Polarized Luminescence, Lanthanide Complex, Chiral, Energy Transfer

Chiral Eu(III) complexes exhibit strong circularly polarized luminescence (CPL) *via* photosensitized energy transfer from the ligand triplet (T_1) state.[1,2] The T_1 spin-polarization is induced by sublevel-selective intersystem crossing.[3,4] In this study, the effect of spin-polarization on the CPL properties of chiral Eu(III) complex containing two photosensitizers, 2,7-bis(diphenylphosphoryl) phenanthrene (dpph) and (+)-3-(heptafluorobutyryl) camphorate ligands (+hfc), is reported for the first time.

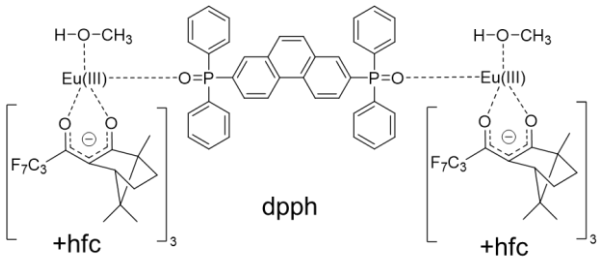

Fig. 1 Chemical structure of **Eu-dpph**.

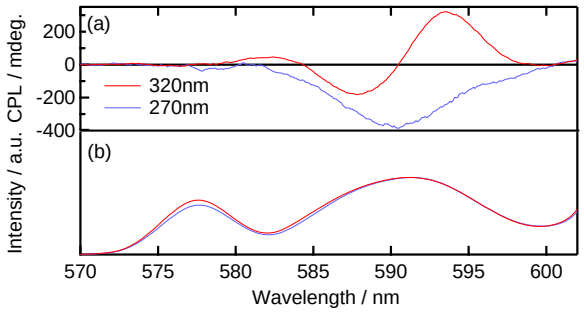

Fig. 2 (a) CPL and (b) emission spectra of **Eu-dpph** at 250 K. Red line: λ_{ex} = 320 nm, Blue line: λ_{ex} = 270 nm.

The Eu(III) complex (**Fig. 1**, **Eu-dpph**) was synthesized by reacting $Eu(+hfc)_3(H_2O)_n$ with dpph in methanol. The compound was identified by ESI-MS and FT-IR. The photophysical properties were characterized by absorption, emission, and CPL spectra.

Strong absorption bands were observed at 320 and 270 nm, which were assigned to the π–π* transitions of +hfc and dpph, respectively. The CPL and emission spectra for the $^5D_0 \rightarrow {}^7F_{0,1}$ transitions are shown in **Fig. 2**. The positive and negative CPL signals at 594 and 588 nm were observed by +hfc excitation (λ_{ex} = 320 nm), while the dpph excitation (λ_{ex} = 270 nm) gave rise to one negative CPL signal at 590 nm. This is the first example of CPL depending on excitation wavelength for Eu(III) complexes, suggesting effective T_1 spin-polarization on the 4f-4f CPL properties.

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