Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C

Supporting information

Thermoswitchable Emission and Coloration of a Composite Material Containing a Europium(III) Complex and Fluoran Dye

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EXPERIMENTAL

Materials and molecular syntheses

The leuco dye, 2-anilino-3-methyl-6-(N-ethyl-N- isoamylamino)leuco, was purchased from Yamada kagaku Co. Ltd.. Developer molecule of 1-(4-hydroxyphenyl)-3-octadecylurea was synthesized by literature method. Europium(III) complex, (1,10-phenanthroline)tris[4,4,4- trifluoro-1-(2-thienyl)-1,3-butanedionato] europium(III), was also synthesized according to literature method by using europium(III) acetate (Wako Chemical), 4,4,4-trifluoro-1-(2- thienyl)-1,3-butanedionato (Tokyo Kasei) and 1,10-phenanthroline (Tokyo Kasei). The host matrix of polymethyl metacrylate (PMMA, Wako Chemical) was used as received.

Preparation of composite films

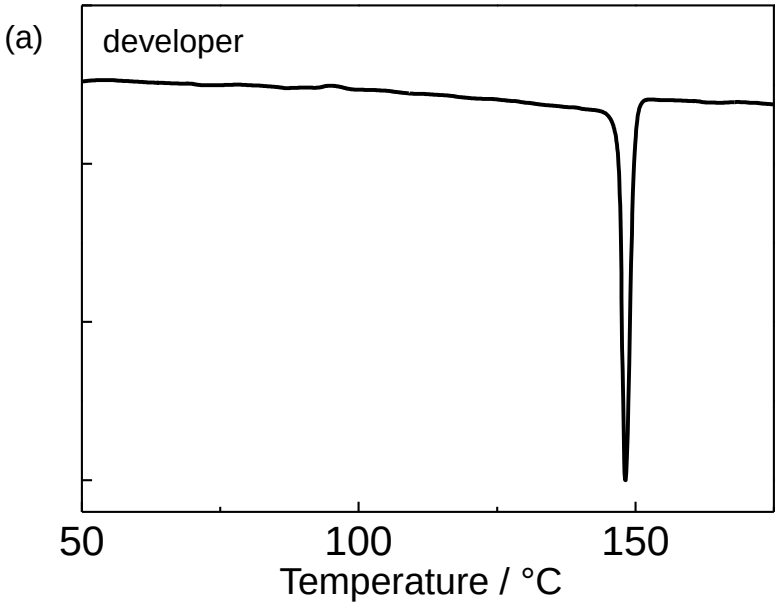
The composite films were fabricated by spin-coating dimethylformamide solution containing leuco dye (100 mmol/L), developer (200 mmol/L), Eu(III) complex (5 mmol/L), and PMMA (10 wt%) on glass substrate. The film thickness was approximately 2.0 μm.

Apparatus

UV-vis absorption spectra of the samples were measured using a spectrophotometer (JASCO, V-570). Photoluminescence spectra were obtained using a spectrofluorometer (JASCO, FP-6600). Excitation wavelength of the samples was 350 nm. The emission lifetimes were determined by using a N_2 laser with a 337-nm wavelength and 4-ns pulse width (Spectra-Physics, VSL337) and a photomultiplier (Hamamatsu Photonics, H10721-20MOD, response time 0.8 ns). Samples were excited by nanosecond pulse of N_2 laser (337 nm). Emission from the sample was guided to the photomultiplier through a sharp-cut filter. Emission decays were monitored with a digital oscilloscope (Sony Tektronix, TDS3052, 500 MHz) synchronized to single-pulse excitation. The quantum yields were determined by standard procedures with an integral sphere (JASCO, ILF-533, diameter 10 cm) mounted on a spectrofluorometer (JASCO, FP-6600). Differential scanning calorymetry curves were obtained with a Differential Scanning Calorimeter (NETZSCH, DSC3100SA).

Fig. 1S

DSC curves of the developer molecule (a) and PMMA (b).



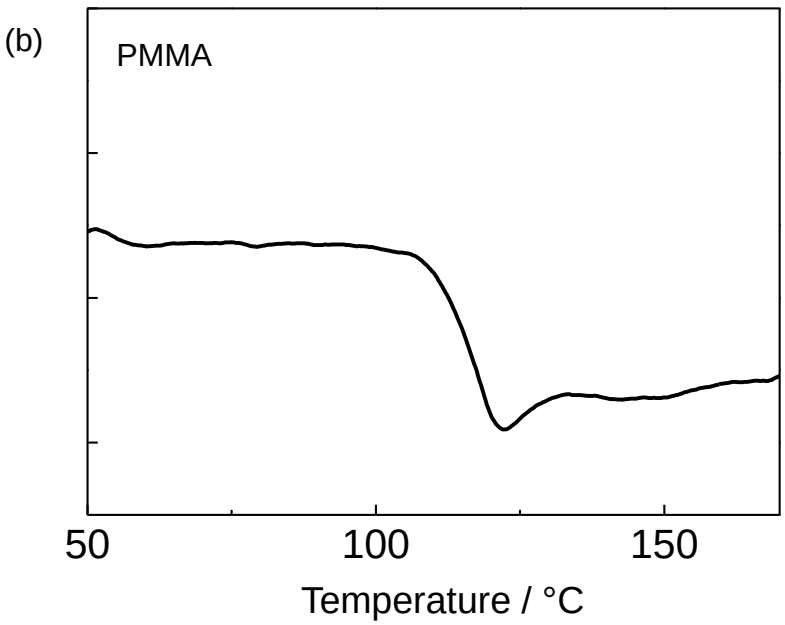


Fig. 2S

Absorption spectra of colored composite film containing fluoran dye and developer with and without Eu(III) complex.

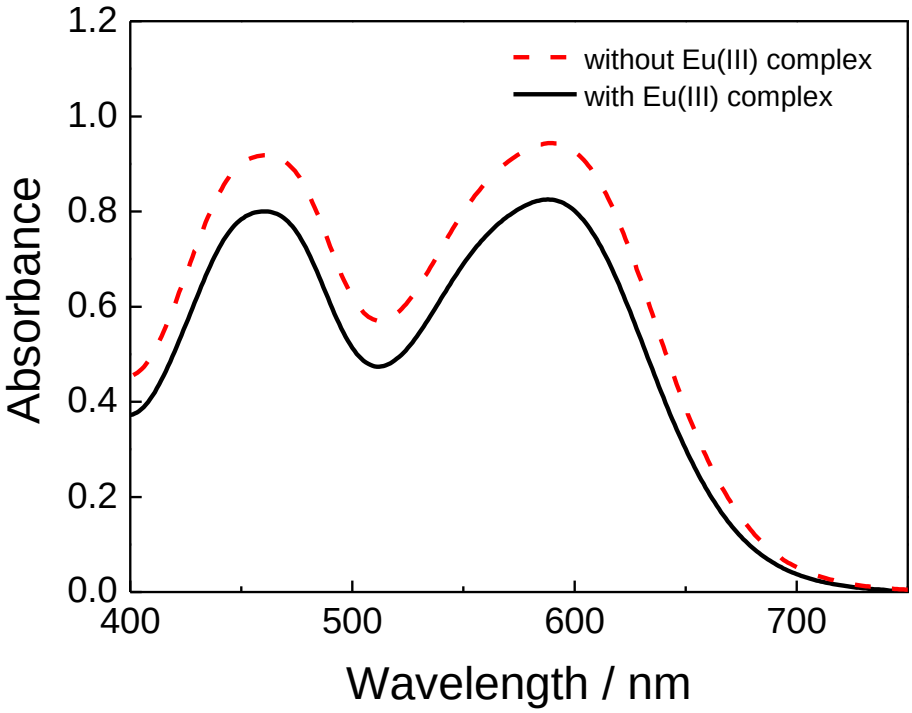


Fig. 3S

X-ray diffraction patterns of the composite film at colored state (black line) and bleached line (red line).

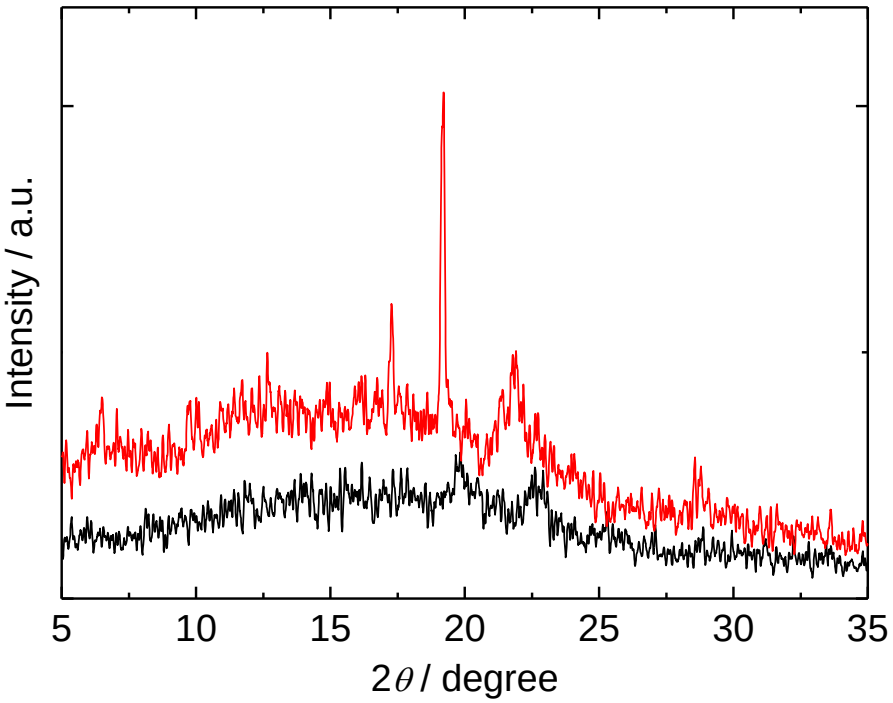


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Fig. 4S

Temperature dependence of the emission intensity of the PMMA film containing only Eu(III) complex under excitation of 365 nm.