

### Enhanced luminescent properties of europium complex by replacement of water molecules by 1, 10-phenanthroline

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The structural tuning of lanthanide complexes as efficient light-conversion devices has become an important pursuit to researchers due to their excellent luminescence properties [1-6]. The excellent luminescence of organic-metal complexes is due to energy transfer from organic ligand to central metal ion by "antenna effect", which can increase the luminescence efficiency. The  $\beta$ -diketones are excellent organic molecules to transfer energy to lanthanide ions [7, 8]. Now-a-days, organic luminescent materials are used commercially for example in laptop computers, mobile phones, car dashboards, advertisement panels, decorating lighting etc.

In present work the The complex [Eu(L)<sub>3</sub>(phen)] (Where L = 2'-hydroxy-4'-methoxy-2-phenylacetophenone, phen = 1,10-phenanthroline) was synthesized and characterized by elemental analysis, energy dispersive X-ray spectroscopy, <sup>1</sup>H NMR spectroscopy, infra red spectroscopy, TGA/DTA, scanning electron microscopy and the excitation as well as emission spectrum. The complex emitting red luminescent might be used to make the electroluminescent devices.

**Elemental analysis:** Elemental analytical data for the complex: C % found = 64.48 (Calc. = 64.83), H % found = 4.53 (calc. = 4.46) and N % found = 2.62 (calc. = 2.65) indicated that the stoichiometry of the complex to be 1: 3: 1 (europium: ligand: co-ligand).

**<sup>1</sup>H NMR spectrum:** Abbreviations used to describe the <sup>1</sup>H NMR spectrum are: s = singlet, d = doublet, t = triplet and m = multiplet. All chemical shifts are given in ppm with respect to tetramethylsilane (TMS). Values for various <sup>1</sup>H NMR chemical shifts are 3.87 (s, 9H, 3 -OCH<sub>3</sub>) 6.9-7.2 (bs, 3H, -CH=), 7.30-7.76 (m, 8H, Aromatic), 7.82-8.14 (m, 2H, Aromatic), 8.30-9.57 (bm, 20H Aromatic), 10.12-10.15 (d, 2H, Aromatic).

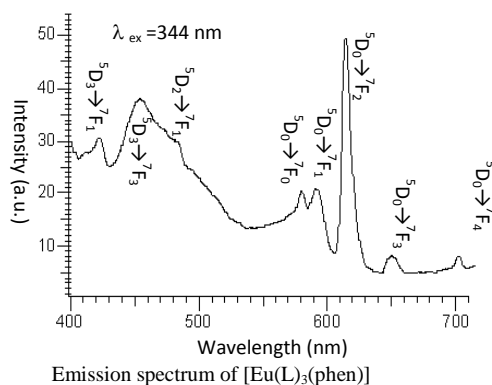
**Infra red spectroscopy:** The infra-red spectrum of ligand showed the characteristic stretching peak at 1638 cm<sup>-1</sup> due to C = O group of the L disappeared in the complex which indicated that the C = O group of the L participated in coordination with Eu<sup>+3</sup> ions. The appearance of new peak at 1609 cm<sup>-1</sup> in complex assigned to C = C stretching mode indicated that the L coordinated with Eu<sup>+3</sup> ions in enolic form. The peak for Ph—O vibration (Ph = phenyl) at 1262 cm<sup>-1</sup> in free L shifted to 1222 cm<sup>-1</sup> in the complex which indicate that the Ph—O group coordinated with Eu<sup>+3</sup> ions. The shift of C—N vibration mode of phen from 1406 cm<sup>-1</sup> to 1390 cm<sup>-1</sup> in complex and the benzene ring C—H bending vibration peaks of phen in high frequency region appearing at 864 and 739 cm<sup>-1</sup> are shifted to 843 and 727cm<sup>-1</sup>, indicating that the chemical bonds are formed between Eu<sup>+3</sup> ion and nitrogen atoms of phen. The bands 1411 cm<sup>-1</sup> and 1452 cm<sup>-1</sup>, 1494 cm<sup>-1</sup> were

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assigned to C—C skeletal vibrational stretching of aromatic ring. Finally, the absorption peak at about 431 cm<sup>-1</sup> in complex can be assigned to the Eu—O vibration absorption band [9]. Overall, the results indicated that phen coordinated with the Eu<sup>+3</sup> ions through nitrogen while L coordinated with the Eu<sup>+3</sup> ions through enolic and phenolic oxygen.

**Thermal stability:** The TGA/DTA curves of the complex show weight loss at about 215°C is due to elimination of phen and the weight loss at about 520°C is due to elimination or decomposition of L. However, above 520°C the complex [Eu(L)<sub>3</sub>(phen)] completely get decomposed.

**Luminescence studies:** The emission spectrum of [Eu(L)<sub>3</sub>(phen)] consists of eight peaks which are due to the transitions (<sup>5</sup>D<sub>3</sub>→<sup>7</sup>F<sub>1</sub>) at 421 nm, (<sup>5</sup>D<sub>3</sub>→<sup>7</sup>F<sub>3</sub>) at 453 nm, (<sup>5</sup>D<sub>2</sub>→<sup>7</sup>F<sub>1</sub>) at 489 nm, (<sup>5</sup>D<sub>0</sub>→<sup>7</sup>F<sub>0</sub>) at 580 nm, (<sup>5</sup>D<sub>0</sub>→<sup>7</sup>F<sub>1</sub>) at 591 nm, (<sup>5</sup>D<sub>0</sub>→<sup>7</sup>F<sub>2</sub>) at 614 nm, (<sup>5</sup>D<sub>0</sub>→<sup>7</sup>F<sub>3</sub>) at 651 nm and (<sup>5</sup>D<sub>0</sub>→<sup>7</sup>F<sub>4</sub>) at 704 nm. Among these, the emission at 614 nm from the (<sup>5</sup>D<sub>0</sub>→<sup>7</sup>F<sub>2</sub>) electronic transition is the strongest and in agreement with the low symmetry around the Eu<sup>+3</sup> ion. The intensity of peaks results by transitions (<sup>5</sup>D<sub>3</sub>→<sup>7</sup>F<sub>1,3</sub>) and (<sup>5</sup>D<sub>2</sub>→<sup>7</sup>F<sub>1</sub>) is less due to competitive non-radiative internal relaxation of from higher <sup>5</sup>D<sub>3, 2, 1</sub> levels to lower <sup>5</sup>D<sub>0</sub> energy level



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