

## Synthesis and Characterization of Lanthanide(III) Complexes based on Ruthenium(II) Organometallic Ligand

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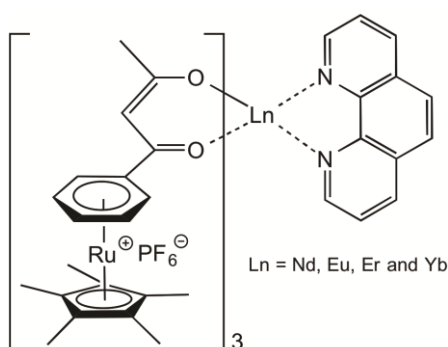
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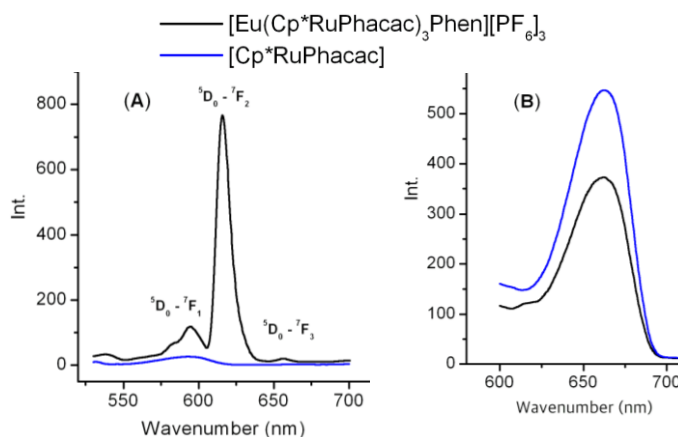
The line-like, narrow emission bands from  $f$ - $f$  states in lanthanide coordination systems can be sensitized through efficient energy transfer from light harvesting antenna chromophores. Traditionally, the sensitization of lanthanide luminescence is achieved by organic aromatic ligands, absorbing strongly in UV-vis spectral region, directly bound to the lanthanide centers.<sup>1</sup> However, the high excitation energy needed in such systems often limits their application, for example to biological systems. A feasible approach to circumvent this type of impediments has been to shift the required excitation domain toward the visible region by modifying the electronic properties of peripheral ligands through introducing electron-donor or electron-acceptor groups. Recently, the introduction of  $d$ -transition metals as part of the ligand has been also proposed.<sup>2</sup>

In this work is presented the synthesis and characterization of new binuclear complexes ruthenium(II)-lanthanide(III) (Fig. 1),  $[\text{Ln}(\text{Cp}^*\text{RuPhacac})_3\text{Phen}][\text{PF}_6]_3$  ( $\text{Ln} = \text{Nd}, \text{Eu}, \text{Er}$  and  $\text{Yb}$ ;  $\text{Cp}^* = \text{C}_5(\text{CH}_3)_5$ ; Phacac = 1-phenyl-1,3-butanedione and Phen = 1,10-phenanthroline), and the respective organometallic  $\beta$ -diketone precursor,  $[\text{Cp}^*\text{RuPhacac}]$ .

The complexes and their corresponding metallo-ligands were characterized by FT-IR,  $^1\text{H}$ -RMN, UV-vis, TGA and Ramman Spectroscopy. Luminescent properties of the new products were teste measuring their emission spectra at room temperature. The optical behavior observed, typical of lanthanide and ruthenium, is illustrated by the spectra of the complex  $\text{Ru}^{\text{II}}\text{-Eu}^{\text{III}}$  shown in Figure 2.



**Fig. 1 - Complexes**  
 $[\text{Ln}(\text{Cp}^*\text{RuPhacac})_3\text{Phen}][\text{PF}_6]_3$ .



**Fig. 2** - Emission spectra of [Eu(Cp<sup>\*</sup>RuPhacac)<sub>3</sub>Phen][PF<sub>6</sub>]<sub>3</sub> and [Cp<sup>\*</sup>RuPhacac] in solid state at room temp,  $\lambda_{\text{exc}}$  (A) = 390 nm and (B) = 470 nm.

## References

1. J.-C. Bünzli, *Coordination Chemistry Reviews*, 19–47, **2015**, 293–294.
2. L.-J. Xu, G.-T. Xu, Z.-N. Chen, *Coordination Chemistry Reviews*, 47–62, **2014**, 273–274.