

# Near infrared spectroscopic properties of new $\beta$ -diketonates lanthanide complexes with different phosphine oxide ligands

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The present work reports the synthesis, characterization and luminescent properties of the  $\text{Ln}^{3+}$ - $\beta$ -diketonate complexes,  $\text{Ln}(\beta\text{-dik})_2(\text{NO}_3)\text{L}_2$ ,  $\text{Ln}(\text{TTA})_3\text{L}_2$  and  $\text{Ln}(\text{DBM})_3\text{L}$ , where  $\text{Ln}^{3+} = \text{Pr}^{3+}$ ,  $\text{Nd}^{3+}$ ,  $\text{Sm}^{3+}$ ,  $\text{Er}^{3+}$  and  $\text{Yb}^{3+}$ ,  $\beta\text{-dik}$  = thenoyltrifluoroacetone (TTA) and dibenzoylmethane (DBM), L = triphenylphosphine oxide (TPPO), tributylphosphine oxide (TBPO), and trioctylphosphine oxide (TOPO). The complexes were characterized by complexometric titration with EDTA, CHN elemental analysis, IR spectroscopy (FT-IR) and thermogravimetric analysis (TGA) [1]. Single-crystal X-ray diffraction analyses reveal that  $\text{Ln}(\text{DBM})_2(\text{NO}_3)(\text{TOPO})_2$  complexes crystallize in the monoclinic space group P21/c with parameters cell:  $a=36.727 \text{ \AA}$ ;  $b=13.752 \text{ \AA}$ ;  $c=15.836 \text{ \AA}$ ;  $\alpha=90^\circ$ ;  $\beta=93.09^\circ$  e  $\gamma=90^\circ$ . Photoluminescent properties in the near infrared (NIR) region were investigated from excitation and emission spectra. Excitation spectra are characterized by the presence of large bands associated with transitions centered on organic ligands, indicating that these ligands act as good sensitizers for  $\text{Ln}^{3+}$  ions that exhibit luminescence in the NIR region. The emission spectra in the NIR region of the *bis*- and *tris*-diketonate complexes of  $\text{Pr}^{3+}$ ,  $\text{Nd}^{3+}$ ,  $\text{Sm}^{3+}$ ,  $\text{Er}^{3+}$  and  $\text{Yb}^{3+}$  ions present the set of intraconfiguration transitions, characteristic of each metal center (Figure 1) [2]. Furthermore, it was observed that changes in the nature and number of ligands coordinated to the  $\text{Ln}^{3+}$  ion slightly influence the spectral profiles. The results obtained from the studied systems suggest that these are potential candidates to act as Molecular Light Converting Devices.

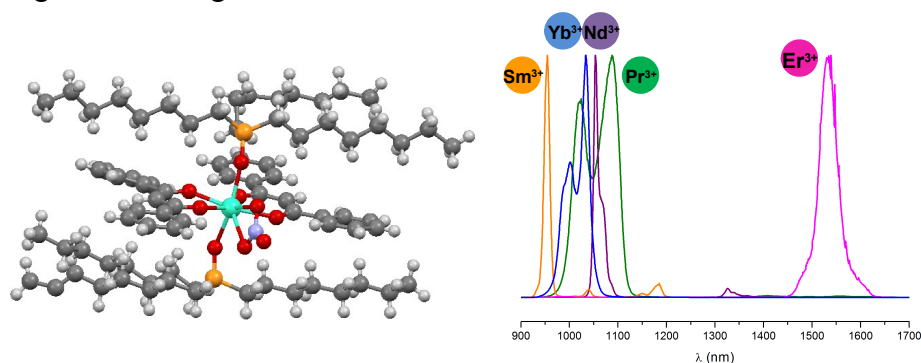


Figure 1. Crystalline structure of  $\text{Ln}(\text{DBM})_2(\text{NO}_3)(\text{TOPO})_2$  and emission spectra for compounds with  $\text{Ln}^{3+}=\text{Pr}^{3+}$ ,  $\text{Nd}^{3+}$ ,  $\text{Sm}^{3+}$ ,  $\text{Er}^{3+}$  and  $\text{Yb}^{3+}$ .

**Keywords:** Lanthanide, Near Infrared Luminescence, Energy transfer.

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## References

- [1] Júnior. F. A. S. *et al.* J. Braz. Chem. Soc. 24 (2013) 601–608.
- [2] J-C. G. Bünzli, Coord. Chem. Rev. 293–294 (2015) 19–47.