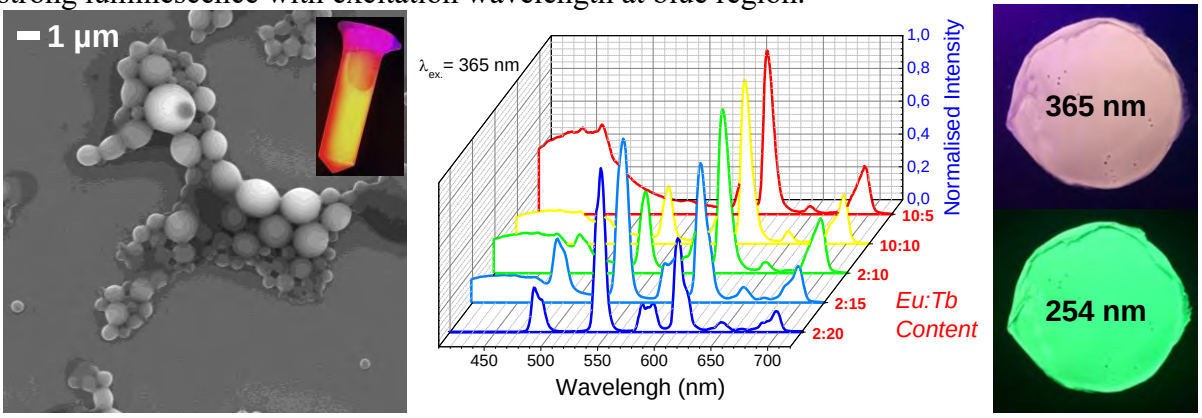
From films to spherical nanoparticles: a versatile approach to design luminescent materials based on polycaprolactone doped with trivalent lanthanide complexes

J. Kai[1,*], H.I. Padilla-Chavarría[1], J.S. Padilha[1], M.F.M.F. Azevedo[1], S.M.V. Dijk[1], M. Cremona[2], Y. Xing[3], C.C.S. Pedroso[4], L.C.V. Rodrigues[4], H.F. Brito[4]

[1] Pontifícia Universidade Católica do Rio de Janeiro, Departamento de Química, RJ, Brazil. [2] Pontifícia Universidade Católica do Rio de Janeiro, Departamento de Física, RJ, Brazil. [3] Universidade Federal Fluminense, Instituto de Física, RJ, Brazil. [4] Universidade de São Paulo, Instituto de Química, SP, Brazil.
** Corresponding author: jkai@puc-rio.br*

Nanostructured polymer materials have attracted noteworthy attention because they are expected to become valuable alternatives in comparison to conventional inorganic materials due to their low cost, easier handling and integration over inorganic counterparts. Since 1973, (1,7)-polyoxepan-2-one (polycaprolactone, PCL) has been known for its biodegradability and biocompatibility [1]; however, not until recently was its utilisation as a host matrix for Lanthanoid-based luminescent systems investigated [2].

Lanthanoid tripositive ions (Ln^{3+}) played essential roles in the modern society mainly due to their intrinsic spectroscopic and magnetic properties, and their coordination compounds are widely applied as catalysts, phosphors, magnets, glasses, lasers, biological optical markers, among others [3]. The exhibition of intense narrow emission bands, originated from the effective shielding of the chemical environment on the 4f electrons exerted by the completely-filled outer sublayers $5s^2$ and $5p^6$, makes Ln^{3+} ions suitable for photonic materials. In this work, we report the preparation of multicolour PCL polymer films doped with tris(acetylacetonate) Eu(III) and Tb(III) complexes. The carbonyl groups of the PCL carbon chain can interact with the Ln^{3+} ions, resulting in an overall increase of the physical and chemical properties of the luminescent materials. Furthermore, spherical nano- and microparticles of size distribution from 200 nm to 2 µm were also obtained, exhibiting strong luminescence with excitation wavelength at blue region.



Keywords: Lanthanide, polycaprolactone, films, nanoparticles, luminescence

Acknowledgements

This work was supported by CNPq, CAPES and FAPERJ.

References

[1] V.R. Sinha, K. Bansal, R. Kaushik, R. Kumria, A. Trehan, Int. J. Pharm. 278 (2004) 1–23.
[2] P.L. Forster, D.F. Parra, A.B. Lugão, J. Kai, H.F. Brito, J. Lumin. 167 (2015) 85–90.
[3] J.-C.G. Bünzli, Coord. Chem. Rev. 293–294 (2015) 19–47.