Chapter 39
Luminescent Labeling of Nanoparticles: SiO_2@$LaPO_4$

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Abstract Nanomaterials are embedded in a variety of products we use daily, e.g. silica nanocrystals are applied in rubber and food. However, more research has to be performed on nano-enabled products to learn more about their environmental and health risks. The demand for guidelines for nanomaterials asks for model-nanosystems that can be traced during their life cycle. In this project, luminescent $LaPO_4$ core particles with sizes ranging from 4 to 8 nm [1] were incorporated into silica nanocrystals. The luminescence properties of the nanocrystal were varied by changing or combining the nature of the lanthanide dopants in the $LaPO_4$ nanocrystal in order to obtain a variety of unique luminescent labels. Silica was grown around the luminescent $LaPO_4$ cores using the reverse micelle method (see Fig. 39.1a) [2]. Silica spheres with sizes between 35 and 85 nm could be obtained by changing the polarity of the dispersion medium of the $LaPO_4$ nanocrystals. The nanocrystals preserved their luminescence properties after silica coating (see Fig. 39.1b). The fluorescent nanoparticles make it possible to use combined fluorescence and electron microscopy for the analysis of the nanoparticles down to the single particle level – and is in progress.

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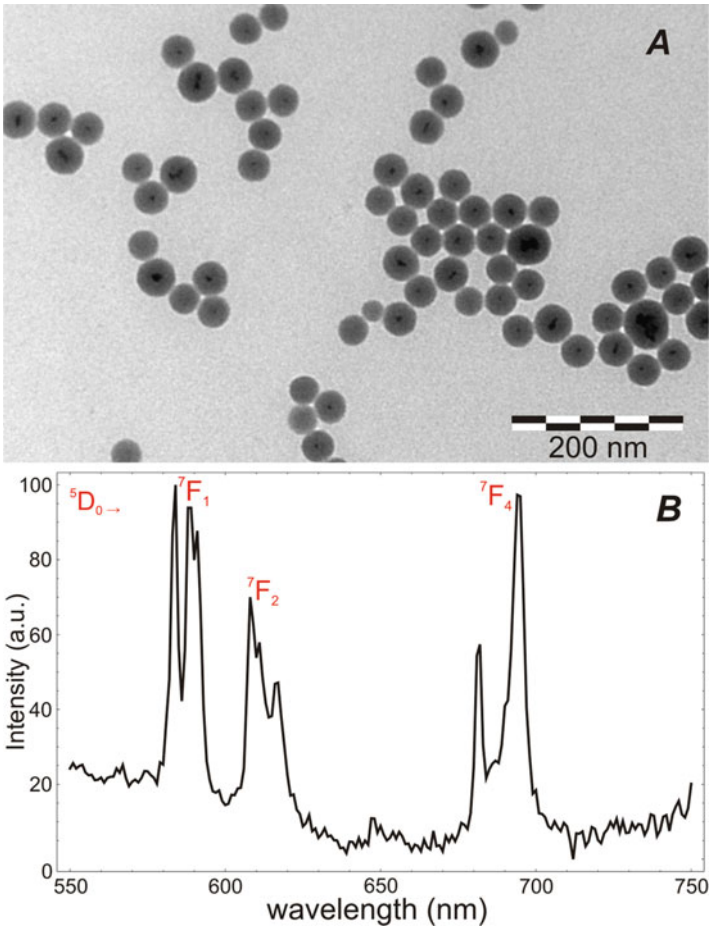

Fig. 39.1 **(a)** TEM image of $LaPO_4:Eu^{3+}$ nanocrystals incorporated into silica spheres of 36.9 ± 3.9 nm. **(b)** emission spectrum of these particles upon excitation at 280 nm

References

1. Hickmann, K., Kömpe, K., Hepp, A., et al. (2008). The role of amines in the growth of terbium(III)-doped cerium phosphate nanoparticles. *Small, 4*, 2136–2139.
2. Koole, K., van Schooneveld, M., Hilhorst, J., et al. (2008). On the incorporation mechanism of hydrophobic quantum dots in silica spheres by a Reverse Micelle Method. *Chemistry of Materials, 20*, 2503–2512.