SYNTHESIS OF LUMINESCENT INORGANIC NANOPARTICLES FOR DISPERSION IN ORGANIC MEDIA

Jean-Luc Lemyre and Anna M. Ritcey
Département de chimie and CERSIM, Université Laval, (Québec), Canada
Email : Jean-Luc.Lemyre@chm.ulaval.ca

Luminescent materials are of great interest for a variety of optical applications including new display technologies and lasers. A number of inorganic compounds doped with lanthanides trivalent ions are known to exhibit interesting luminescent properties. We are investigating the preparation of luminescent inorganic nanoparticles coated with organic surfactants with the objective of incorporating these luminescent inorganic materials into organic environments such as polymer matrices. We have explored several synthetic routes for the preparation of nanoparticles containing rare earth elements. First, a technique using reverse micelles as nanoreactors[1] has been successfully employed to produce nanoparticles of yttrium fluoride doped with trivalent erbium. This method offers a high degree of control over the size of the particles simply through the variation of the water to surfactant ratio. Furthermore, monodisperse particle size distributions are typically obtained. The small volume fraction available within the micelles, however, greatly limits the quantity of particles that can be conveniently produced with this method. We are therefore investigating a second approach, involving the preparation of lanthanum phosphate doped with trivalent lanthanides in high boiling coordinating solvents, as described by Haase *et al* [2]. This technique allows for the production of gram amounts of ligand-capped nanoparticles that can be subsequently dispersed in organic systems.

Another aspect of this project is to understand how the synthesis conditions influence the final characteristics (size, size distribution, shape, crystallinity) of the particles in order to control them. We have already shown that the size of the yttrium fluoride nanoparticles can be conveniently controlled by varying the water content of the reverse micellar system employed for the synthesis, as shown in figure 1.

We have also succeeded in making crystalline and monodisperse particles exhibiting a number of with well-defined shapes, as illustrated in figure 2. The crystalline structure of these nanoparticles is currently under investigation by electronic diffraction.

References:

[1] Petit, Lixon, Pileni
J. Phys. Chem. **1993**, 97, 12974.
[2] Riwotzki, Meyssamy, Schnablegger, Kornowski, Haase
Angew. Chem. Int. Ed. **2001**, 40, 573.

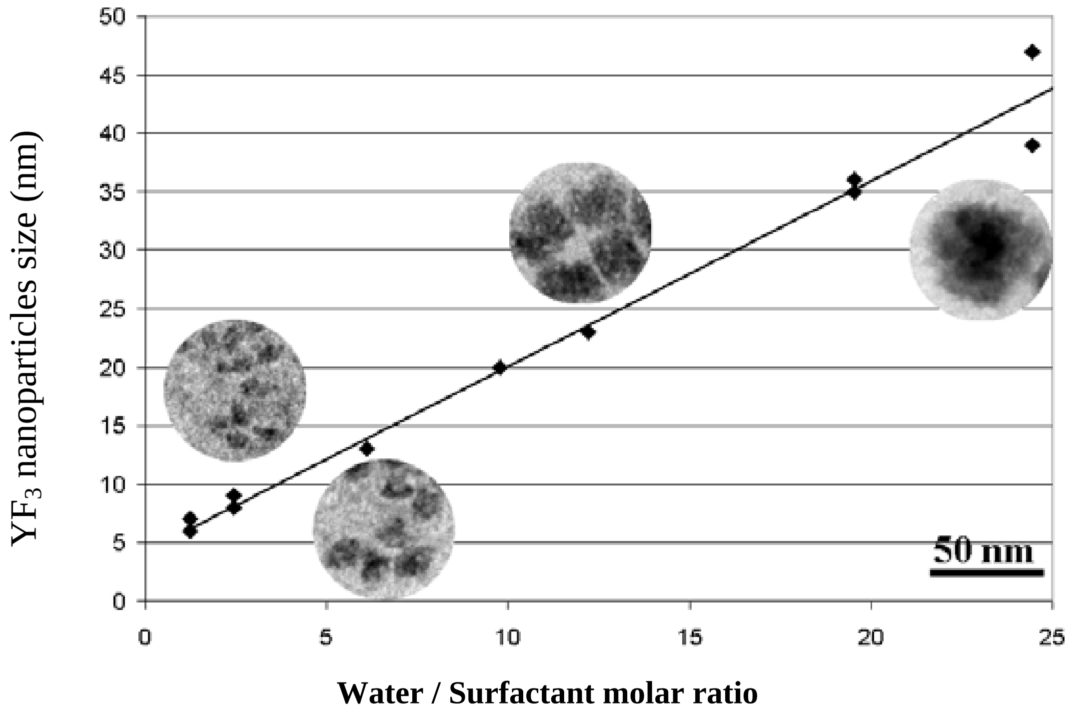

Fig. 1: Size of YF_3 nanoparticles obtained by mixing of microemulsions containing YCl_3 and NH_4FHF as a function of the water content in each of the microemulsions. Particle sizes are determined by TEM.

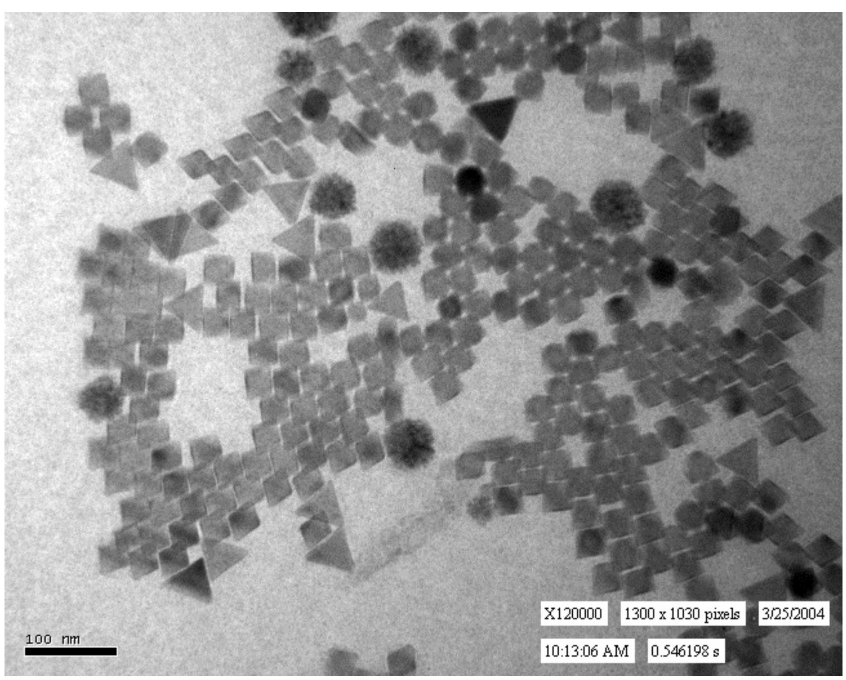

Fig. 2: TEM image of YF_3 nanoparticles obtained by the addition of a NH_4FHF solution to a microemulsion containing YCl_3.