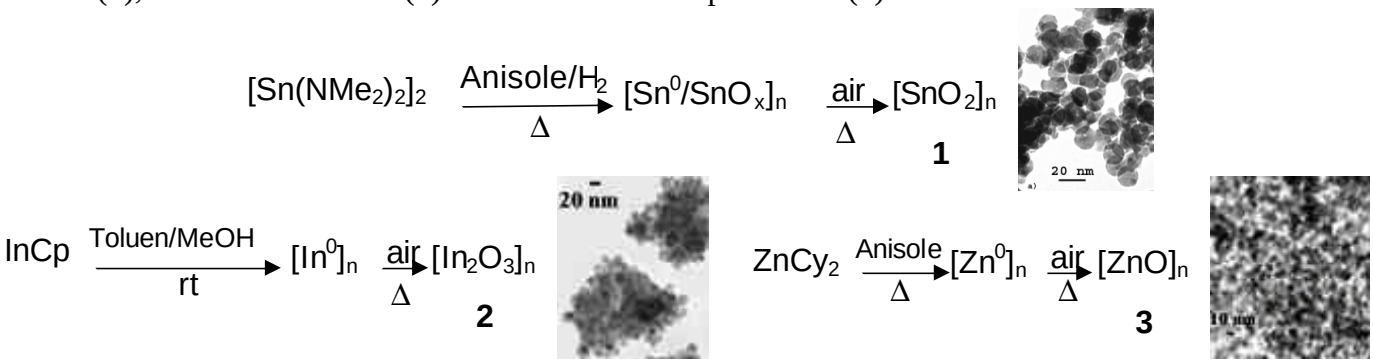
Metal oxide nanoparticles

In our group, we have developed two methods allowing the synthesis of metal oxide nanoparticles starting from organometallic precursors. The first method conssits in a two steps process including the synthesis of metal nanoparticles first, followed by their full oxidation. The first method has been successfully used for the preparation of tin oxide nanoparticles[1] (**1**), as well as indium[2] (**2**) and zinc oxide nanoparticles[3] (**3**).



A new generation of efficient micro gas sensors integrating tin dioxide nanoparticles has been developed in the frame of the EU program NANOSENSOFLEX. These sensors are presently manufactured under CNRS license. Our research is now devoted to the development of the selectivity of these sensors and more specifically we are investigating new doping processes, catalytic filters, and the optimization of the acquisition and processing of the data. The fields of applications concern mass production application and more specifically, the early detection of toxic or flammable gazes.

More recently, we have developed a second organometallic synthetic method for the preparation *at room temperature* of crystalline ZnO nanoparticles of controlled size and shape (Figure 1).[4] This synthetic method takes advantage of the exothermic reaction of the precursor toward water and involves the presence of long-alkyl-chain ligands as stabilizing agents. We started our chemistry looking at zinc oxide. Indeed, ZnO is a wide band gap semiconductor (3,37eV) that displays luminescent properties in the near ultra violet and the visible regions. This material is of particular interest either for its optical and electronic properties.

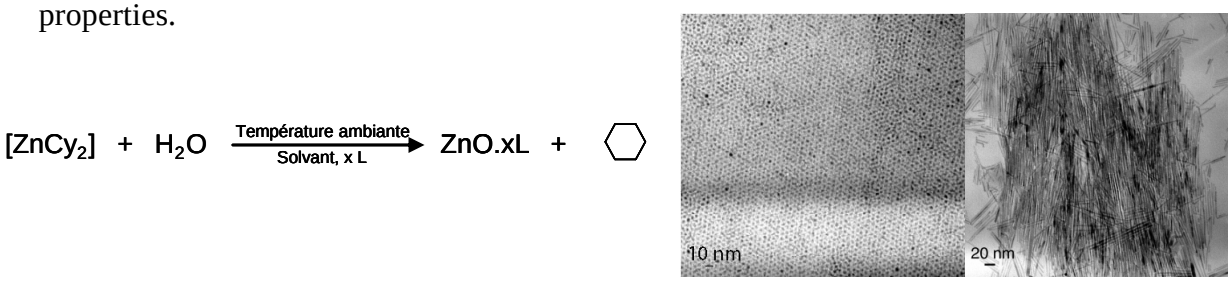


Figure 1: Synthesis and TEM images of ZnO nanoparticles and nanorods.

Using this organometallic method, we have obtained either isotropic nanoparticles or nanorods (Figure 1). This method has been extended to the preparation of magnetic metal oxide nanoparticles as iron oxides.

[1] C. Nayral, E. Viala, P. Fau, F. Senocq, J.-C. Jumas, A. Maisonnat, B. Chaudret, *Chem. Eur. J.* **2000**, *6*, 4082.
[2] K. Soulantica, L. Erades, M. Sauvan, F. Senocq, A. Maisonnat, B. Chaudret, *Adv. Funct. Mater.* **2003**, *13*, 553.
[3] F. Rataboul, C. Nayral, M.-J. Casanove, A. Maisonnat, B. Chaudret, *J. Organomet. Chem.* **2002**, *643-644*, 311.
[4] M. L. Kahn, M. Monge, A. Maisonnat, B. Chaudret, *French Patent CNRS*, Fr 03-042825 (April 7th 2003), PCT/FR/04/00850 (April 6th 2004).