PREPARATION OF FUNCTIONAL HYBRID NANOMATERIALS USING SUPERCRITICAL FLUIDS: A NOVEL APPROACH TO SEPARATE THE GROWTH AND FUNCTIONALIZATION STEPS

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Potential applications of inorganic nanoparticles (NPs) with a functional organic shell have induced tremendous amount of studies, either to control size and shape of the NP core and/or to choose the chemical structure of the stabilizing ligand shell. This allows us to tailor the NPs specific properties towards the many foreseen applications such as electron transfer applications (electronics, catalysis, electrochemistry, photochemistry) or lock–key interaction applications (recognition, gene delivery, sensoric operation). Nevertheless, methods generally used present a lack of flexibility and two main drawbacks are generally found: (i) the control on one NP parameter like core size is often obtained through limitative growth conditions that necessitates the use of specific solvent, reducing and functionalizing agent; (ii) the surface modification of the shell (by exchange or chemical reaction) was restricted to a limited number of cases.
We will report on a versatile synthetic method capable of producing a wide variety of NPs possessing tunable peripheral chemical functionalities by separating the growth and the functionalization steps [1]. The control of inorganic core characteristics is insured by using supercritical fluids as a reaction media without using a stabilizing agent. In a second step, the NPs were sprayed into a glass vessel containing a functionalising agent in solution at the normal conditions of pressure and temperature. This method was successfully applied to the synthesis of palladium NPs capped with three different kind of stabilizers: thiol derivatives, functionalized polymers [2] or ionic liquids. Their application in catalysis will be discussed.

References.
[1] S. Moisan, J.-D. Marty, F. Cansell and C. Aymonier **Chem. Commun**, **2008**, 1428-1430
[2] M. Dumont, S. Moisan, C. Aymonier, J.-D. Marty, C. Mingotaud, soumis