CLÉMENTINE MANSAS

will present her Ph.D. dissertation

Synthesis of core-shell nanoparticles to entrap radioactive cesium

The defense will take place on **Thursday, November 23, 2017** at **2.00 pm**

in the ICSM Auditorium

The research work described below is based on the synthesis and the study of core-shell nanoparticles able to entrap radioactive cesium. A sorption process of radionuclides on porous silica monoliths has already been described to capture radioactive cesium and to anchor it on a solid phase. Those materials were therefore functionalized with Prussian Blue Analogous (PBA) nanoparticles or more precisely $K_2CuFe(CN)_6$ (CuPBA) that are well known to be highly selective towards Cs. However, those materials did not allow optimal Cs sorption because of strong aggregation of PBA nanoparticles within the monoliths. Thereby, the solution developed is the use of core-shell nanoparticles in order to avoid the PBA aggregation. The core of these nanoparticles is made with PBA and protected by a porous silica shell.

A reverse microemulsion is chosen as main synthetic route to synthesize and control the size and shape of these nanoparticles. That synthetic route allows in-situ synthesis of CuPBA nanoparticles in the microemulsion with an excellent stability of the particles in the water droplets. Microemulsions, characterized with SAXS, show droplets radius varying from 0.5 to 3 nm with regard to the water content defined by w parameter (w=[H_2O]/[surfactant]). The growth of the silica shell is then achieved after the synthesis of CuPBA, using a classical basic conditions sol-gel process. The morphology of the core-shell nanoparticles is controlled with HRTEM/STEM-HAADF and the structural and chemical analysis are followed by XRD and FTIR-ATR. Finally, this study enables, for the first time, the synthesis of these core-shell nanoparticles. Then, recent sorption experiments highlighted that these core-shell nanoparticles can be used to entrap cesium with interesting capacity ((Qmax(core-shell NPs)=125 mg/g)). Moreover, these nanoparticles are useful for decontamination process and they open the way in the study of the self-irradiation and self-containment of radionuclides.

Keywords: Nanoparticles; core-shell; decontamination; cesium; microemulsion