Ph.D. defense

Institut de Chimie Séparative de Marcoule / CEA Marcoule
(UMR 5257, CEA, CNRS, Université Montpellier, ENSCM)

SOLÈNE BERTOLOTTO

will present her Ph.D. dissertation

Study of the reactivity of UO_2 single crystals towards dissolution processes in nitric acid medium

The defense will take place on **Wednesday, November 25th, 2020** at **10.00 am**
in the ICSM Auditorium

The dissolution in concentrated nitric acid constitutes the head-end step of the reprocessing of the spent nuclear fuel (SNF). After their stay in the nuclear reactor, SNF develop high heterogeneities in terms of chemical composition, elementary distribution and microstructure, which lead to significant changes in SNF dissolution rates. Currently, the impact of the material properties on the dissolution is not well established and considered in the available macroscopic models. In this context, the dissolution of UO_2 single crystals with defined (100), (110) or (111) oriented surfaces, presenting simple geometry and microstructure was studied.

The multi scale observation of UO_2 single crystals during dissolution in nitric acid media at room temperature, allowed the improvement of our understanding regarding to the role of the oriented surface on the dissolution mechanism developed at the solid/liquid interface. First, at the macroscopic scale, two consecutive dissolution regimes (non-catalysed then catalysed) were highlighted regardless of the oriented surface. The oriented surface as well as the microstructural defects, such as roughness, had a slight impact on the dissolution rates for both dissolution regimes. However, the development of cracks spreading occurring during the non-catalysed step reduced its duration. Moreover, at the microscopic scale, followed via the Scanning Electron Microscopy (SEM), the development of balance topographies characteristic of each oriented surface was evidenced. The resulting topographies were mainly composed of (110) oriented surfaces. Finally, at the nanoscopic scale, structural defects were underlined and were responsible for the formation of triangular etch pits on the (111) oriented surface. Thus, their development controlled the dissolution kinetic of this oriented surface during the non-catalysed step.

Keywords: Reprocessing; nuclear fuel; UO_2; dissolution single crystals