

## Ph.D. defense

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

**RÉMI BOUBON**

will present his Ph.D. dissertation

### **Evolution of the interface between the MgZr alloy and the geopolymer matrix**

The defense will take place on **Friday, November 27th 2020 at 9.00 am**  
in the ICSM Auditorium

This study is dedicated to the understanding of the behavior of the intermediate level legacy nuclear waste in repository, and more specifically, of the MgZr alloy cladding coming from Natural Uranium Graphite Gas reactors, encapsulated into an inorganic geopolymer potentially selected as a conditioning matrix. These nanoporous aluminosilicates are good candidates since their poral solution presents high pH (12.5) which leads to a significant decrease of the Mg-Zr alloy corrosion. In addition, it is possible to add a corrosion inhibitor such as NaF in the poral solution during their preparation. The aim of PhD is to study the evolution over time of the MgZr alloy surface within geopolymer by understanding the processes underlying the formation of corrosion products and by characterizing the impact of the corrosion inhibitor NaF. To reach this goal, three experimental systems were used to study the evolution of the surface of the corroded MgZr alloy (i) in poral solution (PS), (ii) embedded in geopolymer and (iii) cover by a thin film of geopolymer. During these experiments, the surface of MgZr was characterized by grazing incidence-X ray diffraction, microRaman and infrared spectroscopies and by scanning and transmission electron microscopies coupled with elementary analysis. These experiments showed that the amount and the availability of dissolved species in poral solution such as silica and fluoride are the key parameters driving the nature and the amount of corrosion products formed. Indeed, without NaF, brucite and magnesium silicates were characterized. The precipitation of magnesium silicates occurs within the corrosion layer in poral solution and inside the geopolymer porosity probably due to the diffusion of dissolved magnesium. In presence of NaF, magnesium silicates and more or less substituted Brucite  $Mg(OH)_{2-x}F_x$  formed depending on the amount of NaF. When fluorine species in solution are in sufficient quantity,  $NaMgF_3$  precipitates. The isomorphic substitution of OH by F can be related to a decrease of the porosity of  $Mg(OH)_{2-x}F_x$ . This result may explain the passivating effect of this phase by reducing the transport of the poral solution through the corrosion products layer.

Keywords: Mg alloy; Corrosion; Geopolymer; Poral solution; corrosion products

