



Post-doctoral position (2 years)

Laboratoire des Solides Irradiés, UMR7642, CEA-CNRS-Ecole Polytechnique, France

Crystallochemistry and structural study of phosphocalcic apatites for the conditioning of long-lived radionuclides

Context: This post-doctoral project is part of the French project “D-CLIC” within the investment program “France 2030” to innovate in terms of radioactive waste management in deep geological disposal. The D-CLIC project focuses more particularly on the fate of three long-lived radionuclides, namely ^{14}C , ^{36}Cl and ^{129}I , characterized by a high mobility in the environment. The objective is thus to confine them efficiently in a matrix with high chemical durability (i.e. presenting a low level of alteration by interaction with dissemination vectors such as water). To achieve this goal, it is proposed to design calcium phosphate –based materials with an apatitic structure. Indeed, apatites are a class of minerals with remarkable durability properties and their structural flexibility makes it possible to consider both an isolated or joint incorporation of each of the targeted elements.

Activities: The aim of this project is to compare two synthetic routes for the production of phosphocalcic apatites intended to incorporate iodate, chloride and/or carbonate anions: a ceramic route (co-precipitation followed by sintering at low temperature) and a cementation route (in which the solution containing the anions to be insolubilized will constitute the mixing solution). The goal of the post-doc is to study in depth the crystallochemistry of substituted apatites, as a function of the elaboration conditions, concentrations of anions and proposed combinations. In the case of apatites obtained by the ceramic route, the aim is also to study their thermal stability in order to assess their resistance to sintering.

Skills: PhD in Material Sciences, Solid Chemistry. Solid background in crystallography, powder XRD & Rietveld method; experience in vibrational spectroscopies and NMR.

Work context: The candidate will work at Laboratoire des Solides Irradiés, located on the Polytechnic School campus, at just 20 Km South of Paris. She/He will join the D2SM team (Defects, Disorder and Structuring Matter) and will be supervised by Marie-Noëlle de Noirfontaine (CNRS researcher) and Mireille Courtial (Associate Professor). He/She will work in close collaboration with the XRD platform “DIFFRAX” of Polytechnique School and the colleagues of SOLEIL synchrotron for the analyses by vibrational spectroscopies (Raman and IR). The project will interact closely with the other teams of the project (CEA, CIRIMAT-Toulouse and ICB-Dijon). He/She will write publications produced by this research and communicate her/his results at conferences.

Dates: desired start date: early April 2024 (for a period of 24 months)

Job applications: interested candidates should address their Curriculum-Vitae including a list of publications and a one-page cover letter including a summary of past research activities, and the name of people who can be contacted for reference, to the two following contacts:

marie-noelle.de-noirfontaine@polytechnique.edu ; mireille.courtial@polytechnique.edu