



## **Ph.D. Opening**

# **Optimization of quantitative electron-probe microanalysis of actinide materials**

### LOCATION and DURATION

Université Montpellier (France) with short stays at the Universitat de Barcelona (Spain) and CEA - Pierrelatte - Cadarache (France)

3 years (the contract will start on October 2008)

### CONTEXT and OBJECTIVES

The understanding of the behaviour of nuclear fuels under all operating conditions (in-pile, accident or long-term storage conditions), requires a set of thermomechanic, neutronic or thermodynamic modelling tools. These approaches are based on experimental tests and studies associated with the application of analytical techniques to irradiated materials. However, such techniques are too complex to master in a “shielded” environment and with irradiated materials. In this framework, the present Ph.D. proposal will contribute to support material studies in nuclear R & D (e.g., advanced nuclear fuels based on carbide and nitride actinide compounds) by improving quantitative methods for the analysis of irradiated materials by electron-probe microanalysis (EPMA). The goal of the present Ph.D. project will be to deliver reliable analytical methods to quantify the local composition of actinide materials. Emphasis will be put in the analysis of minor actinide elements and eventually light elements (B, C, N and O) contained in heavy-matrix materials. In a first stage, the study will consist of evaluating all the parameters involved in the analytical methods (sample preparation, reference standards, analysis conditions, physical and instrumental parameters, quantification algorithms etc...), with emphasis in the most crucial ones. In this context, Monte Carlo simulation will be used to assess the reliability of physical parameters involved in the quantification algorithms. In a second stage, a standardless method of analysis will be proposed for application to actinide materials. The method will be tested on Uranium compounds, validated on Plutonium compounds and extrapolated to Americium compounds. This second stage is part of a European Project sponsored by the network ACTINET, which federates partners from different countries: Belgium (SCK/CEN), Germany (ITU), France (CEA and CNRS), Spain (UB) and Switzerland (PSI). The Ph.D. proposal may include complementary measurements of basic parameters such as the ionization cross section or the mass absorption coefficient and modelling of algorithms for quantitative analysis (especially for light elements in actinide materials). The proposal combines a fundamental and physical approach to understand the different phenomena with an industrial interest to optimize the analysis of nuclear fuels.

### REQUIREMENTS

The candidate will have a high level in physics, modelling and aptitude for experimentation

### DEAD LINES and BURSARY

15 04 08/1600-1900 euros monthly

### CONTACTS

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