

Laser heating of nuclear fuels for experimental studies of thermal transients

Context

The internship work should be conducted within a project in the general context of investigations on current and future nuclear fuels, particularly their behavior under thermal loads representative of nominal operating or accident conditions in nuclear reactors. The project aims at developing an experimental device that can subject nuclear fuels to annealing tests involving very high temperatures (up to 3000°C) and that can analyze the behavior of these fuels during such annealing tests: gas and fission product releases, restructuring kinetics. This system must be able to easily reach the desired conditions which currently require the installation of complex instruments that rule out the possibility of conducting a series of experiments one after the other. It will be designed to study real fuels (irradiated or fresh) for multi-objective R&D programs needed to address the industrial and fundamental issues.

Objectives

To reach these objectives, the student will participate in developing an original laser heating technique coupled with different diagnostic systems designed to analyze the surface condition of the samples (high-resolution imaging, infrared thermography). On the one hand the student will work on numerical simulations of laser material interactions with a Finite Element Solver software (COMSOL Multiphysics), and on the other hand the student will be involved in the experimental development of the laser material interaction platform, based on a high power laser.

The student will work in close collaboration with engineers and researchers of the laboratory specialized in analyzing the migration of radioelements (LAMIR) within the Fuel Studies Department (DEC) at the CEA Cadarache Centre.

The 'laser-matter interaction' group at the Fresnel Institute will provide the expertise in the field of high power laser interactions with materials and optical instruments for the development of the system and related optical diagnostics (high-resolution imaging, optical thermography).

Practical details

The student will have a CEA internship position.

Salary: 700 to 1300€ depending on the student profile.

Location: 90% Institut Fresnel, 10% CEA Cadarache

Perspectives

The subject will be continued with a PhD (CEA/ECM grant).

Contacts: yves.pontillon@cea.fr laurent.gallais@fresnel.fr