

Polytech network form for PhD Research Grants from the China Scholarship Council

This document describes the PhD subject and supervisor proposed by the French Polytech network of 14 university engineering schools. Please contact the PhD supervisor by email or Skype for further information regarding your application.

Supervisor information	
Family name	Pr. POIRIER
First name	JACQUES
Email	Jacques.poirier@univ-orleans.fr
Web reference	http://www.cemhti.cnrs-orleans.fr/ see <u>Transparent (Glass) Ceramics & Refractory Ceramics</u>
Lab name	CEMHTI-CNRS Extreme Conditions and Materials: High Temperature and Irradiation
Lab web site	http://www.cemhti.cnrs-orleans.fr/
Polytech name	Polytech Orleans
University name	University of ORLEANS
Country	France

PhD information	
Title	High-performance ceramic materials: study of transport properties of refractory castables to optimize their drying out

Main topics regards to CSC list (3 topics at maximum)	High-performance ceramic materials Environmental behavior and failure of materials
Required skills in science and engineering	Ceramic Materials, High Temperature, Physical Chemistry, Laboratory experimentation, Modelling

Subject description (two pages maximum)

High-performance ceramic materials: study of transport properties of refractory castables to optimize their drying out

Dry out of refractory castables is the longest step among all the processing steps (mixing, placing, curing and drying) and has a significant impact on the global performance and cost (energy consumption, production halt, mechanical damage caused during drying, explosive spalling, etc.) The drying process is a complex phenomenon depending on the microstructure, the shape and the size of the cast part, the boundary conditions... and involves both heat transfer, vapour diffusion, and water movement by capillarity. Although the process has been studied for a long time, curing time and drying schedule are mostly based on empirical knowledge. On the other hand, some studies proposed complex models taking into account all the physics, involving many properties whose some are difficult to measure, and requiring large computations to solve all the partial differential equations. **The optimization of dry out process of refractory castables is still challenging.**

The research proposed here is intermediate approach between the empirical knowledge and the complex modelling. Its objectives are:

- To identify and analyse different castables dry out situations conducted with success or failure;
- To determine the transport properties of these castables during curing and dry out steps: porosity, pore size distribution, permeability, and capillary forces;
- To elaborate a typology based on major factors impacting success or failure in drying process
- To develop operational and pragmatic dewatering simulation models using major properties identified in the previous items.

The PhD student will work at the laboratory, in Orléans, within the team “Refractory material: design and corrosion” and in contact with the other teams of the lab. It will be then possible to carry out other techniques of spectroscopy or analysing – especially MRI, HT XRD, Raman, and SEM-EDS.

The student will hold a Master degree on the 1st of September 2019, at the latest.

PhD director: Pr. Jacques Poirier

Co-supervisor: Dr. Emmanuel de Bilbao

Start of the PhD study: Oct. 2019.

For further information please contact:

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