Open PhD Position in European Industrial Doctoral Network (DN-ID)

www.cesaref.eu

Concerted European action on Sustainable Applications of REFractories (CESAREF)

What is CESAREF and what is the focus of this network?

CESAREF will train researchers in multi-engineering areas and expose them to the academic and non-academic sectors through international and inter-sectoral mobility combined with an innovation-oriented mind-set. They will get the right combination of research-related and transferable competences in the **full production-to-the-end-of-life cycle of refractory materials applied to Iron & Steelmaking processes** with regards to the new operation conditions requested by the drastic reduction of greenhouse gas emissions, improved energy efficiency, and by life cycle assessment requirements. An important part of the project will be dedicated to the sustainability of refractories, including recycling issues, using the **Life Cycle Assessment** methodology. **15 doctoral candidates** will take advantage of the most sophisticated numerical tools and laboratory equipment to model, design and predict the life of refractory materials in critical operational conditions. Being trained in scientific, technical, and soft skills, these PhDs are the next generation of highly employable scientists and engineers in the refractory sector and related areas. New testing methods and models will be developed to address the Scientific/Technological challenges for these applications and help to design better performing and sustainable refractory materials and linings. The research training is implemented through strong relationships between 10 academia and 16 industrial partners across the EU. The CESAREF network (www.cesaref.eu) is structured to take full advantage of intensive cooperation between **academia**, **raw material suppliers**, **refractory suppliers and high-tech metal component producers** with a direct link to the **FIRE federation (fire-refractory.org)**.

Specific subject of PhD10 (one of 15 PhD's of the CESAREF DN-ID project)

PhD10 Topic: Microstructural impact on refractory materials during *in situ* testing by means of X-Ray imaging methods

Objectives: The microstructure of refractory materials are undergoing changes during its operation leading to degradation. The microstructure, like grain boundary, particle packing, pores and microcracks, strongly affect the materials parameters, such as thermal conductivity, elasticity, or mechanical strength. The microstructure is studied via X-Ray based imaging methods, namely X-Ray computed tomography as well as X-Ray based refraction radiography and tomography to gain knowledge about the pore structure and crack propagation after or while being in an operation-like environment in terms of heat and load.

Expected Results: The commonly used refractory materials, spinel castables (containing and forming), mullite as well as fused-silica-based refractories, undergo significant microstructural changes during their use in refractory field. Hence, a more detailed knowledge of the degradation mechanisms is of great importance and gives important hints to the cause of their performance drop and how to circumvent those.

Keywords: Spinel castables, mullite, silica based refractories, microstructure, X-Ray tomography, crack propagation

Applicant Profile: **Master's level in *Materials Science, Materials Engineering or Physicist***. Candidates should be excellent in their skills for experimental work, knowledge of material physics and/or heat transfer mechanisms, oral and written communication skills (English). Knowledge of sample preparation and instrumentation will be appreciated.

PhD main locations:

Period 1 - SAFRAN (www.safran-group.com), Colombes, France (18 months)

Period 2 - BAM (www.bam.de), Berlin, Germany (18 months)

Due to the Mobility Rule by the funding agency, residents of France cannot apply for this PhD10 position

Apply until June 27th following indications at www.cesaref.eu/recruitment-procedure

If you have any questions, feel free to contact the supervisors:

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