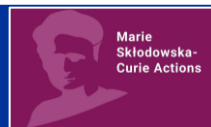




## Open PhD Position in European Industrial Doctoral Network (DN-ID)



[www.cesaref.eu](http://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](http://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](http://fire-refractory.org)).

#### Specific subject of PhD5 (one of 15 PhD's of the CESAREF DN-ID project)

##### PhD5 Topic: Characterization of refractory material properties after usage for recyclability determination

**Objectives:** For most refractory applications, materials are often pre-fired at low temperature in comparison to industrial application conditions. Key thermal and mechanical properties will thus dramatically change after a first usage. For example, the components used in continuous casting process are presently 100% based on virgin raw materials because of the extreme service conditions and safety issues. This work will provide a deep analysis of specific property variations after usage in comparison to properties as new to qualify the recyclability after one or more usage cycle.

**Expected Results:** Quantify material properties at high temperature (thermal conductivity, thermal expansion, Young's modulus, Stress-strain law, fracture energy, etc) after usage in comparison with initial state. These property changes will be considered in FEM model to determine potential recyclability. Considering the evolutions of the most critical properties, non-destructive testing will be considered for validation.

**Keywords:** Minerals, microstructure, refractory materials, thermo-mechanics, high temperature process

**Applicant Profile:** **Master's level in Materials Science and/or Materials Engineering.** Candidates should be excellent in their skills for experimental characterisation technics and knowledge of materials science, refractories and/or ceramics. A specific skill in thermo-mechanics is also required. Oral and written communication skills (English) are mandatory.

#### PhD main locations:

Period 1 - VESUVIUS ([www.vesuvius.com](http://www.vesuvius.com)), Ghlin, Belgium (18 months)

Period 2 - IRCER ([www.ircer.fr](http://www.ircer.fr)), Limoges, France (18 months)

**Due to the Mobility Rule by the funding agency, residents of Belgium cannot apply for this PhD5 position**

Apply until June 27<sup>th</sup> following indications at [www.cesaref.eu/recruitment-procedure](http://www.cesaref.eu/recruitment-procedure)

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

Prof. Marc HUGER, [marc.huger@unilim.fr](mailto:marc.huger@unilim.fr) Dr. Nicolas TESSIER-DOYEN, [nicolas.tessier-doyen@unilim.fr](mailto:nicolas.tessier-doyen@unilim.fr),  
Séverine ROMERO-BAIVIER, [severine.romero.baivier@vesuvius.com](mailto:severine.romero.baivier@vesuvius.com)

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