

## PhD Offer

### *Methodology for techno-economical and environmental assessment of innovative technologies: Case of a functionalized coating technology using pulsed plasma*

In the framework of the Interreg Grande Région PULSATEC, a PhD position is available in the Department of Chemical Engineering at the University of Liège. The objective of the PhD is to develop a methodology for assessing the sustainability (techno-economical, environmental and social) of innovative technologies. The pulsed-plasma technology will serve as a case study for this European project.

#### **Context**

Currently, several industrial technologies coexist for the coating of surfaces with functionalized layers. In the present project, the focus is set on metallic oxide films, and in particular Zinc oxide. Resulting materials properties are numerous: Conductive coating of insulating materials, UV or IR filtering, de-icing, de-dusting... As a consequence, the use of such materials covers various fields such as synthesis of PV cells elements, transparent electronic materials (photodiodes, touch screens...). However, industrial coating technologies are limited due to the high energy expense, and to the difficulty to treat objects with complex shapes, non-homogeneous surface, or even heat sensitive.

In the PULSATEC project, the idea is to develop a unique expertise for the coating of complex surfaces using pulsed plasma and HiPIMS technology (High-power impulse magnetron sputtering). The project includes 5 scientific partners and 7 strategic technology end-users whose goal is to implement the technology at industrial scale after project completion.

Usually, a Life Cycle Assessment (LCA) is performed to evaluate the environmental sustainability of a new technology. However, the techno-economical aspect as well as the social impact are rarely considered. In the case of the pulsed plasma technology, these aspects are also important and the present PhD thesis should study them.

### **PhD thesis objectives**

The objective of the PhD thesis is to develop a methodology for the holistic comparison of new innovative technologies with conventional ones. The methodology will include techno-economical analysis, as well as life cycle assessment and possibly social aspects. The goal is to supply decision makers with rational tools to evaluate the intrinsic sustainability of a new technology.

This methodology will be developed with the case study of the pulsed plasma coating of objects with complex shapes. Based on data supplied by project partners and literature, the PhD student will study and compare the potential of pulsed plasma coating with alternative conventional technologies. The comparison will address techno-economical criteria, as well as life cycle assessment.

First, the PhD student will build a process model for pulsed plasma as well as for alternative technologies (sol-gel, electrolysis coating...). This model will be calibrated to fit material and energy balances, and it will be used to reconcile available experimental data as a starting point for the following steps. Next, equipment and operating conditions will be optimised. Techno-economic characterization of the new coating process will follow and the results will be compared to conventional processes. Life cycle assessment of the selected technologies will be conducted, for which the Department of Chemical Engineering has a 15 year+ experience. Social aspects may also be considered for technology evaluation.

### **Profile**

The candidate has a Master degree in Engineering, with focus on chemical engineering, process engineering or environmental engineering.

Knowledge of English is required, French is strongly recommended. Ability to work independently and to take initiatives is a plus.

### **Research environment**

About 60 people work in the Department of Chemical Engineering at ULiège. They are mostly active in the fields of Process engineering and Material Sciences. The Department develops experimental research, as well as modelling activities for (bio) chemical process simulation, control and optimization. Activities target the emergence of sustainable and economically viable materials and technologies. More than 10 different nationalities are present in the Department and collaboration with partner universities is encouraged. More information: [www.chemeng.uliege.be](http://www.chemeng.uliege.be).

### **Application**

Application must be sent by e-mail before July 31, 2018 to [g.leonard@uliege.be](mailto:g.leonard@uliege.be). Application must include:

- CV
- Cover letter
- References

Starting date: October 1, 2018

Duration: 3 years

The thesis will be conducted at the Department of Chemical Engineering, B6A Sart-Tilman, 4000 Liège.

Conditions: Interreg PhD Grant (~1800€ net/month)