Doctoral School MEGeP
« Mechanics, Energetics, Civil Engineering,
Process Engineering »

# Thesis proposal for a Doctoral position 2017-2020

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| **Title** | Development of an oxidative CVD process<br>for deposition of conductive polymers thin films |
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| **Laboratory** | Laboratoire de Génie Chimique |

**Research project description :**

Conductive polymers attract more and more attention these last years because they are multifunctional organic materials combining optical transparency, lightness, electrical conductivity, and they can be deposited on flexible substrates like plastics or fabrics. As a consequence, their potential applications concern innovative fields such as organic solar cells, flexible electronic devices, anti-fouling coating in particular for filtration systems.

Most of these applications necessitate to coat complex substrates presenting submicronic trenches or pores, by conductive polymer thin films with an excellent conformity. Contrarily to classical deposition processes which use liquids, the oCVD (oxidative Chemical Vapor Deposition) process meets this objective thanks to the use of gaseous precursors at reduced pressure. Moreover, the presence of an oxidant allows to operate at temperatures lower than 100°C, which opens the possibility to coat thermosensitive substrates. This process does not use any toxic or aggressive solvent, allowing the treatment of papers, plastics, fabrics and polymeric membranes.

The PhD project concerns the development of an oCVD reactor by combining experimental work and process numerical modelling, in order to understand the phenomena involved during the deposit (nucleation/growth phenomena, role of the oxidant, …), to optimize their characteristics (thickness, uniformity, chemical composition, …) and their properties (electrical conductivity, mechanical resistance, optical transparency, …).

Moreover, the oCVD reactor will be equipped with a quartz microbalance, allowing a precise *in situ* measurement of the deposition rates in real time. The obtained information will allow to better understand the nucleation/growth phenomena, in particular during the first steps of deposition. An accurate study of the deposition kinetics will also be conducted.

The PhD work will be organized in collaboration with CIRIMAT, for the characterization of polymer thin films.