



**Master thesis proposal 2025- 2026:**

**Plasma activation of textiles for the design of amphiphobic coatings**

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**Context.** Amphiphobic coatings are designed to repel both aqueous and oily substances on materials surfaces. These combined hydrophobic and oleophobic properties are required in many industrial and medical applications to prevent biofouling, corrosion or food contamination. For instance, these coatings are present in many in- and outdoor textiles like those used for military attire, not only for their self-cleaning ability but also for preventing the penetration of CBRN type (Chemical Biological Radiological Nuclear) toxic warfare agents.

Nowadays, there is one large family of organic compounds endowing these unique properties and which are very widely used: the poly and perfluoroalkyl substances abbreviated as PFAS. They contain many C-F bonds highly stable under  $CF_2$  or  $CF_3$  units. However, these PFAS, considered now as forever chemicals, present real environmental and health risks, which will lead to their prohibition by 2030. It is therefore necessary to find alternatives.

**Objective.** The AMPHITEX project is aimed at developing innovative amphiphobic and sustainable textiles combining surface activation, multi-scale structuration and functionalization with silicone-based materials. The project involves 5 teams within three IP Paris laboratories: PMC laboratory and LSO “organic chemistry laboratory” at the Ecole Polytechnique and «Chemistry and Processes» unit at ENTSA. In the ECM team at PMC lab, we mainly work on the activation of textiles by physical processes such as light, UV-ozonolysis, and plasma to generate new chemical functions and roughness on the surface of textiles.

The objective of this M2 internship is to focus on the optimisation of the oxygen/water plasma to create hydroxyl groups on various types of fabrics (cellulose, viscose, polyester, aramide and mixtures of them). The treated fabrics will be analysed by Infra-Red (IR) and X-Ray (XPS) spectroscopies and by SEM (scanning electron microscopy) imaging. The wetting properties before and after the activation will be determined by contact angle measurements. The effect of the activation on the efficiency of the grafting of silicone-based materials will also be investigated.

**Key-words:** plasma activation, fabrics, surface chemistry, wettability

**Competences/knowledges:** mainly in material sciences (chemistry or physics) and in surface technics (IR and XPS spectroscopies)

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