Photoreactive Surfaces and their Impact on Plasma Polymers

The research project:

Surface modification offers the possibility to physically or chemically change the surface of a material in order to provide a new property. Among the procedures for surface modification, plasma enhanced chemical vapor deposition (PECVD) of polymerizable precursors, commonly referred as plasma polymerization offers several advantages when compared to other strategies [1]. For instance, it is performed in the absence of solvents and catalysts, since reactive species are generated from a vapor phase and can recombine on virtually any surface. The chemical nature of the surface is well-known to play a role in the good attachment of the plasma polymer to the substrate. However, there is an absence of studies and effort dedicated to isolate the phenomena involved in the plasma polymer growth. The current internship proposal focuses on the identification of how plasma polymers growth kinetics and structures are affected by the presence of a photoinitiator on the surface. The kinetics of growth of plasma polymers and their structural and physico-chemical properties will be evaluated. The internship thus involves the understanding of fundamental aspects of the deposition and growth of plasma polymers that can be further directed to generate original and in situ bottom-up processing strategies. The main goal of the proposed internship will be focused on the **impact of surface physico-chemical properties on the formation of plasma polymers**. In order to target the surface physico-chemical properties, the intern is expected to prepare self-assembled monolayers and work on their functionalization through photo-chemical approaches. After thorough characterization of those surfaces, selected operating conditions of plasma polymerization should be tested and the impact of surface properties on the plasma polymers properties assessed. The **6-month internship** will be carried in the **Institute of Materials Science of Mulhouse (IS2M, France)** in the thematic axis: **Interfaces and Multidimensional Materials**. This internship work plans to provide preliminary results to be followed by an ANR financed PhD student to be hired in 2026.

The missions of the intern:

The intern will **tailor the physico-chemical properties** of model substrates through the generation of **self-assembled monolayers** and **photo-chemistry**. She/he will carry out **plasma polymerization** and perform chemical, physico-chemical and morphological characterizations of the polymers using the available techniques at the IS2M (contact angle measurements, ellipsometry, infrared spectroscopy (FTIR), X-ray photoelectron spectroscopy (XPS), atomic force microscopy (AFM) ...).

Skills to be developed:

Thanks to this internship, the intern will develop disciplinary skills in materials chemistry, particularly in surface characterization as well as in plasma treatments. More generally, she/he will learn how to work within a research team, exploit data, use scientific databases, write a report and communicate on her/his results.

References:

(1) Carneiro de Oliveira, J.; Meireles Brioude, M. de et al., Plasma polymerization in the design of new materials: looking through the lens of maleic anhydride plasma polymers. Materials Today Chemistry 2022, 23, 100646.

Candidate profile and application:

Second year master student or student in last year of engineering school. Education in chemistry and / or materials science is required. The candidate will have to show initiative and seriousness for this project. He/she should also have good organization and communication skills.

Applications including a CV, a cover letter and a copy of grades (last 2 years) should be sent by e-mail.

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