



PhD: 2023-2026

Materials chemistry

CIFRE grant with:

Aptar
Val De Reuil, France

and

Institut de Science des Matériaux (IS2M)
Université de Haute-Alsace - CNRS - Mulhouse, France



Proposal for a PhD position (2023-2026)

Development of elastomeric gaskets with barrier properties for cosmetic / pharmaceutical formulations

Research topic

Aptar is a global leader in drug delivery, consumer product dispensing and active material science solutions. We use insights, design, engineering and science to create dosing, dispensing and protective packaging technologies for the world's leading brands – small marvels of sophisticated engineering and innovative design that make a meaningful difference in the lives, looks, health and homes of millions of people around the world. We offer a full set of associated services to support customer speed-to-market.

On Aptar Val De Reuil site, our main focus is to develop and manufacture gaskets used in our metering valves for pressurized metered dose inhalers, and multidose pumps, for perfumes, cosmetics or nasal drug delivery.

The subject of this PhD project is to develop an elastomer-based gasket with barrier properties to cosmetic, perfumery or pharmaceutical formulations used in dispensing devices without degrading their mechanical and elastic performance (properties compatible with assembly and final application).

The chemical resistance of the gaskets may be provided by the surface functionalization of the gasket and/or possibly by an improvement in the formulation of the latter. This study will aim to increase the gasket's impermeability with respect to molecules in contact (mainly present in liquid form). The innovative materials and surface treatments offered will be developed to meet customer and market needs and in compliance with the new REACH standards.

Objectives of the PhD

The main objectives of this PhD project are:

- to investigate the physico-chemical surface properties of chosen elastomers in contact with small organic molecules; particularly to understand the spatio-temporal diffusion of the product in the material.
- to functionalize the elastomer using either plasma treatment or self-assembly process to increase the barrier property of the seals.
- to investigate the mechanical performances of the treated (and not) elastomers sealing gaskets in contact (or not) with small organic molecules using a multiscale approach; the aim is to understand the critical parameters inducing ageing of elastomers and its loss of mechanical properties during molecules delivery.
- to propose a binary system allowing improving the long term stability of the gasket.

LOCATION:

Institut de Science des Matériaux de Mulhouse

68057 Mulhouse
FRANCE

And

Aptar

27100 Val De Reuil
FRANCE

CONTACTS:

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Karine Mougín

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GRANT INFORMATION:

Duration:

Three years full-time
Starting from Oct. 2023

Funding:

CIFRE grant

HOW TO APPLY?

Applications including a CV, a cover letter and a copy of grades (last 2 years) should be sent electronically to Florence Bally-Le Gall and Karine Mougín as soon as possible and no later than May 15th 2023.



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The PhD student will first be responsible for investigating the physico-chemical properties of elastomers gaskets in contact (or not) of small organic molecules. He/she will carry out physico-chemical surface treatment (plasma coating and self-assembly) and characterization by Fourier Transform Infrared Spectroscopy, Raman spectroscopy, surface NMR and X-Ray Photoelectron Spectroscopy. These techniques are suitable to characterize surface properties of the elastomers and follow their spatio-temporal chemical modification. In a second step, the mechanical properties of the elastomers will be investigated at different scale using at macroscale DMA, and at microscale Atomic Force Microscopy to try to understand how the constraints induced in the elastomer affect the diffusion of organic molecules in the material and lead to a decrease of the elastomer performances.

At last, the PhD student will propose an optimized gasket formulation/treatment, that can be transferred and used in an industrial environment.

The PhD student will be part of the team working on the project within Aptar, in an international environment. He/she will thus present his/her work during specific meetings, and will share his/her vision on the short and long-term activities related to the project.

The candidate

The candidate should have a background (Master or Engineer degree or equivalent) in material science, chemistry and good skills in surface science. A strong interest in multidisciplinary approaches (material science, and chemistry and physics), autonomy and good experimental skills are highly recommended.

Organization of the PhD work

This work will be co-supervised by Dr K. Mougin, Dr. F. Bally-Le Gall, Dr. A Ponche (IS2M) and M. Moreau (R&D Manager, Aptar Val De Reuil). The candidate will be recruited by Aptar (27100 Val De Reuil, France) but the major part of the work will be made in Institut de Science des Matériaux de Mulhouse (IS2M, 68057 Mulhouse, France)

ADDITIONAL INFORMATION:

<https://www.aptar.com/>
<https://www.is2m.uha.fr/>