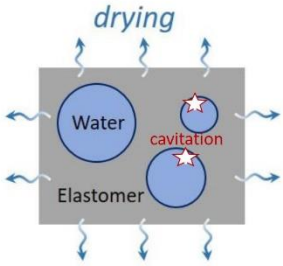
Open postdoc offer

Controlled cavitation in polymer foams- towards new metamaterials

Soft elastomer foams are promising materials for different applications [1], including sensing, soft actuation or acoustic metamaterials. However, a major scientific deadlock for the fabrication of these materials is the control over the pore size: it is still a challenge to reliably make pores below the 1 µm which would enable metamaterials with micro-architectured or gradient porous structures [2]. Indeed, at this "colloidal" lengthscale, the classic foam polymerization methods are poorly controllable and more innovative "template" methods are required. However, we have recently shown [3] that even the template methods suffer from many drawbacks especially related to drying. The nucleation of gas bubbles inside small pores is slow and the soft pores prefer to irreversibly collapse giving a non-porous material.

We aim to challenge this problem by applying controlled mechanical solicitation to induce the cavitation of gas bubbles in polymer foams upon drying. The postdoc will use a simple emulsion-templated technique to elaborate model systems with varied pore diameters, porosities and mechanical properties of polymer matrix. He/she will develop a new experimental setup to visualize the reopening of the pores under mechanical stress. If interested, he will also be given the opportunity to participate in continuum scale modelling of deformation and fluid transport in these porous materials under capillary and adhesive stresses using numerical methods. These studies will support material development and explain the collapse phenomenon which origin is still poorly understood. From a practical point of view, the project aims at proposing protocols which minimize pore collapse without using expensive methods such as supercritical drying.



This one-year postdoc position is a part of the 4-year ANR project MAGELAn (2020-2024). We are looking for an enthusiastic candidate with strong background in soft matter physics and mechanics. Please contact the project supervisors first by sending an application email which should include a CV, a motivation letter and contact information of references.

Contact:

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Starting date: flexible, from September to November 2021

References:

1. Zhu et al. J. Mater. Chem. A 2017, 5 (32), 16467–16497. https://doi.org/10.1039/C7TA04577H.
2. Jin et al.. Nature Communications 2019, 10 (1), 143. https://doi.org/10.1038/s41467-018-07990-5.
3. Nguyen et al. Soft Matter 2020. https://doi.org/10.1039/D0SM00932F.