

Magnetic elastomer foams for stimuli-responsive surfaces

This M2 internship offer is part of the 4 year ANR project MAGELAn. The project includes an open PhD position starting in October 2020 at Laboratoire de Sciences et Ingénierie de la Matière Molle (SIMM-ESPCI) in Paris.

Responsive or "smart" surfaces are coatings which properties can be changed by an external stimulus, such as temperature, light, electric or magnetic field. In recent years, patterned surfaces with magnetically-tunable wetting¹ or adhesion² properties were designed based on elastomers or hydrogels filled with magnetic particles. However, the fabrication protocols are rather expensive and difficultly scalable. Porous polymers and polymer foams are versatile materials which mechanical properties can be tuned by the choice of matrix and controlling of the porosity and pore size.

The main aim of the MAGELAn project is to fabricate magnetically-responsive coatings composed of soft magnetic polymer foams with small pore sizes ($d \sim 1-10 \mu\text{m}$). The main interest of smaller pore sizes is to assure good spatial homogeneity of the mechanical properties. In order to obtain controlled porosity, we will use colloidal templates³ (emulsions and dissolvable particles). The synthesized materials will be used to understand the relationship between the structure and properties of soft magnetic foams. In particular, we will be interested in the influence of the magnetic particle distribution on the magnetorheological and adhesive properties of the foams.

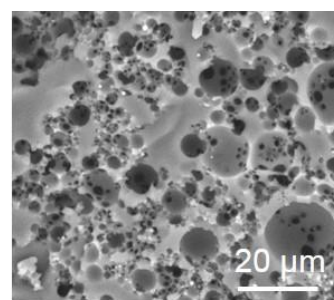


Figure: PDMS foam fabricated by an emulsion-templated approach.

The M2 internship will focus primarily on the fabrication and mechanical properties of the foams. The intern will work at SIMM laboratory (<https://www.simm.espci.fr>) with internationally recognized reputation in polymer materials and benefit of the interdisciplinary environment of ESPCI school. He will be directly supervised by A. Kovalenko and E. Barthel. The work will be in collaboration with J. Fresnais from PHENIX lab at Sorbonne University.

We are looking for an enthusiastic candidate motivated to pursuing with a PhD. Candidates with experimental skills and theoretical background in material science, polymers, physical chemistry or mechanics are encouraged to apply. The application email should include a CV, one page motivation letter and contact information of at least two referent persons.

Contact: Artem Kovalenko, artem.kovalenko@espci.fr.

References:

- (1) Drotlef, D.-M.; Blümmler, P.; Papadopoulos, P.; del Campo, A. *ACS Appl. Mater. Interfaces* **2014**, *6* (11), 8702–8707.
- (2) Drotlef, D.-M.; Blümmler, P.; del Campo, A. *Advanced Materials* **2014**, *26* (5), 775–779.
- (3) Kovalenko, A.; Zimny, K.; Mascaro, B.; Brunet, T.; Mondain-Monval, O. *Soft Matter* **2016**, *12* (23), 5154–5163.