DOCTORAL THESIS IN MATERIALS SCIENCES AND ENGINEERING

Design, synthesis, and nanoscale characterization of materials for soft robotics applications

PhD open position within the doctoral network "Soft Active Matter Microrobots for Medicine (SAM3)", funded by EU HORIZON-MSCA-2025-DN-01-01 # 101312674

Collaboration with Prof. Pierre LAMBERT (ULB, Brussels, Belgium), Prof. Daniele MARTELLA (LENS, Firenze, Italy), Prof. Johann MICHLER (EPFL and Empa, Thun, Switzerland) and Dr. Jean-Marc BREGUET (Alemnis AG, Thun, Switzerland)

Research project on Design, synthesis, and multiscale characterization of materials for soft robotics applications (SAM3/ESR12 – soft robotics)

This project takes place within the Marie Curie Doctoral Network on Soft Active Matter Microrobots for Medicine (SAM3). This doctoral network of 12 PhD candidates aims at exploring the ear-nose-throat area from a microrobotics perspective. Thanks to active matter and small scale microrobotics engineering, three specific goals are targeted: (1) access the middle ear through the Eustachian tube; (2) access the olfactory clefts for mucosal biopsy; (3) access the skull cavity through the nose and the cribble plate for cerebrospinal fluid biopsy.

This specific PhD project will focus on design, synthesis, and multiscale characterization of materials for soft robotics applications and has application in all three endoscopic areas. The goal of the PhD is to computationally design using a simulation-guided approach and synthesize via light-based 3D-printing architecture (meta)materials for medical soft robotics applications. Furthermore, the morphology, microstructure, and mechanical behaviour of the metamaterials for soft robotics applications will be characterized as a function of environmental and boundary conditions in order to identify structure-property-function relationships.

The expected results are further set as follows: 1) **Functional architectured material designs and synthesis routes via 3D printing** with applications in medical soft robotic applications. 2) **Characterization setup for probing mechanical behaviour of active and passive materials** for soft robotics applications under various boundary conditions (variable strain rate, relative humidity, etc.). 3) **Multiscale characterization of materials and systems** developed in the SAM3 project in terms of process-structure-mechanical property-function relationships.

The candidate will be enrolled as PhD student at the Doctoral School for Materials Science and Engineering (EDMX) of EPFL (Lausanne, Switzerland) under co-supervision with Dr. Jakob Schwiedrzik and Prof. Dr. Johann MICHLER at EPFL and Empa (Thun, Switzerland) and will be based at the Laboratory for High Performance Ceramics of Empa (Dübendorf, Switzerland).

An academic stay of 3 months is planned at ULB (Prof Pierre LAMBERT, Bruxelles, Belgium) for the design of metamaterials for soft robotics, a second academic stay of 3 months is planned at UMONS (Prof Jérémy ODENT, Mons, Belgium) for the synthesis of soft robotics materials and an industrial secondment of 5 months is planned at Alemnis AG (Dr Jean-Marc BREGUET, Thun, Switzerland) for micromechanical testing of metamaterial structures.

Research environment

The main research lab will be the Laboratory for High Performance Ceramics (https://www.empa.ch/web/s201) of Empa Swiss Federal Laboratories for Materials Science and Technology (Dübendorf, Switzerland).

The PhD student will be jointly supervised by Dr Jakob SCHWIEDRZIK (Empa, Dübendorf, Switzerland) and Prof. Johann MICHLER (EPFL and Empa, Thun, Switzerland).

Both supervisors of this project have complementary expertise towards the goals of this PhD: mechanical design, microfabrication and multiscale characterization.

More information on the supervisors:

- Dr Jakob SCHWIEDRZIK (https://www.empa.ch/web/s201), Head of Laboratory for High Performance Ceramics at Empa, leading research in the fields of architectured materials and multiscale correlative material characterization.
- Prof. Johann MICHLER (https://www.empa.ch/web/s206), Head of Laboratory for Mechanics of Materials and Nanostructures and Associated Professor at EPFL, leading research in the fields of thin film materials and small scale mechanics.

The Laboratory for High Performance Ceramics of Empa is equipped with all necessary facilities (workstations and simulation software, chemical labs, DLP and 2 Photon Lithography 3D printing, Raman spectroscopy, electron microscopy, nanoindentation, macroscopic mechanical testing, humidity control) for design, manufacturing, and metamaterial characterization. The laboratory is situated at the main campus of Empa in Dübendorf near the city of Zürich.

For the implementation of the project, the candidate will move for 3 months to ULB (Belgium), 3 months to UMONS (Belgium) and 5 months to Alemnis (Thun, Switzerland).

Job description and profile for SAM3/ESR12

We will appoint 1 PhD student on this project, related to 11 other positions open in the SAM3 EU network.

He/she will be registered within Doctoral School in Materials Science and Engineering Sciences at EPFL (Lausanne, Switzerland) with Prof. Johann Michler and Dr. Jakob Schwiedrzik as supervisors.

The candidate should have a Master degree or diploma in materials science, mechanical engineering, or similar, less than 5 years of career at the recruitment date and not having a doctoral degree.

We are seeking talented and enthusiastic students to perform a PhD, with a solid background in mechanics of materials and simulations. Experience with material characterization using electron microscopy, nanoindentation, or other methods, and light-based 3D printing is an advantage.

Regarding soft skills, the candidate should have strong motivation for research (curiosity, commitment, teamwork spirit and open to discussions with colleagues, science, modelling, experiments, writing and communication skills).

The candidate should have good command of spoken and written English, and German or French skills are of course an asset.

For more information regarding the PhD studies at the EMPA please check the website (https://www.epfl.ch/education/phd/edmx-materials-science-and-engineering/).

How to apply

Applications should be sent to the mailbox SAM3@umons.ac.be dedicated only to recruitment. They should include: a) a digital copy with all academic certificates and the respective official transcription in English; b) a detailed CV and a motivation letter in English; c) 2 letters of recommendation.

Duration: 3 years full time.
Starting date: From October 2026
Deadline for the submission of applications: 15/7/2026 though the position will remain open until it is filled.