DOCTORAL THESIS IN SCIENCES

Electromechanically responsive materials for tethered robotic and sensing functions

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 Prof. Jérémy ODENT (UMONS, Mons, Belgium), Prof. Cédric PLESSE (CERGY, Cergy-Pontoise, France), Dr Jakob SCHWIEDRZIK (EMPA, Dübendorf, Switzerland) and Dr Anne DELETTRE (Percipio, Besançon, France)

Research project on Electromechanically responsive materials for tethered robotic and sensing functions (SAM3/ESR1 – electromechanics)

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 proposal on electromechanically responsive materials for tethered robotic and sensing functions is part of the first endoscopic area namely the middle ear. The goal of the PhD is to develop 3D-printable electromechanically responsive materials based on mechanical-to-ionic transduction to navigate safely in the Eustachian tube.

The expected results are further set as follows: 1) **Ionic polymeric materials** composed of one electrolyte layer laminated with symmetric electrode layers and generating actuation deformations based on reversible ion migrations between electrolyte and electrode for robotic function; 2) **Solid-state polyelectrolytes** generating a transient voltage based on the separation of ions of different mobilities under pressure for sensing function; 3) **Hybrid ionic systems** combining the above materials to deliver reversible electromechanical response for simultaneous actuating and sensing modes, enabling proprioception.

The candidate will be enrolled as PhD student at UMONS (Mons, Belgium), in the doctoral degree of sciences. A co-supervision is planned with Prof. Jean-Marie RAQUEZ at UMONS also.

An academic stay of 5 months is planned at CERGY (Prof. Cédric PLESSE, Cergy-Pontoise, France) for the design of electroactive actuators, a second academic stay of 4 months is planned at EMPA (Dr Jakob SCHWIEDRZIK, Dübendorf, Switzerland) for the 2PP structuration and materials characterization at the microscale and an industrial secondment of 3 months is planned at Percipio Robotics (Dr Anne DELETTRE, Besançon, France) for prototype combining sensing and actuation.

Research environment

The main research lab will be the SMPC department (https://www.smpc.be/) of the Faculty of Sciences at Université de Mons (UMONS, Nimy Campus, Mons, Belgium).

The PhD student will be supervised by Prof. Jérémy ODENT (UMONS, Mons, Belgium) and co-supervised by Prof. Jean-Marie RAQUEZ (UMONS, Mons, Belgium).

Both supervisors of this project have complementary expertise towards the goals of this PhD: polymer design and synthesis, additive manufacturing technologies.

More information on the supervisors:

- Prof. Jérémy ODENT, associate professor at the SMPC of UMONS, leading research in the field of stimuli-responsive polymeric materials and nanocomposites of desired properties and key-functionalities as well as the possibilities sustained by advanced additive manufacturing technologies to meet the ever-increasing demand of complex device platforms.
- Prof. Jean-Marie RAQUEZ, head of the SMPC lab which is internationally recognized for (1) the synthesis of polymers of tailored and well controlled molecular structures, and (2) the production of (nano)filled polymers and/or (nano)filled polymer blends by (reactive) melt processing, reactive bulk impregnation, (nano)particle functionalization, grafting and encapsulation.

Allowing a step-by-step follow up of the materials from its conception to its fate, SMPC takes advantage of its expertise in macromolecular engineering and polymer processing to design well-defined materials while its equipment facilities offer in-depth characterization and better understanding of resulting properties. For the implementation of the project, the candidate will move for 5 months to CERGY (France), 4 months to EMPA (Switzerland) and 3 months at Percipio Robotics (France).

Job description and profile for SAM3/ESR1

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

We are seeking talented and enthusiastic students to perform a PhD, with a solid background in polymer and organic chemistry, with a strong interest in materials engineering. He/she will be registered within Doctoral School in Sciences at UMONS with Prof. J. Odent and J.-M. Raquez as supervisors.

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

For more information regarding the PhD studies at the UMONS please check the website (https://web.umons.ac.be/en/recherche/le-doctorat/).

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: Autumn 2026
Deadline for the submission of applications: 15/7/2026 though the position will remain open until it is filled.