

3 years PhD position

*Centre for Materials Forming (CEMEF) of MINES ParisTech
Sophia Antipolis, France
and
Institute of Biomolecules Max Mousseron (IBMM)
Montpellier, France*

3D printing of biobased polymer aerogels for biomedical applications

financed by the French National Centre for Scientific Research (CNRS)

Thesis description

Wound management is nowadays one of major health issues. This problem will increase in the future because of the aging of the population, in particular, with chronic wounds (bedsores, diabetic ulcers...). Wound dressings are one of the most important systems for wound management; they can have various forms ranging from foams to hydrocolloids and hydrogels. Very recently, it has been demonstrated that certain polysaccharide solutions can be used to "print" hydrogels in complex forms, which is particularly useful for wound dressings that often require unique shapes.

The objective of this project is the 3D printing of bio-aerogels and evaluation of their use as drug-releasing wound dressings. Bio-aerogels are highly porous, nanostructured materials with a large internal surface area; they are obtained with non-toxic processes from solutions and hydrogels of polysaccharides. The project is at the interface of materials science (biobased polymers, aerogels, 3D printing), chemistry (polymer functionalization) and biomedical applications (wound dressings, controlled release). The principle of additive manufacturing will be used to make the aerogels. A new approach, phase separation, will be tested to shape the material, which allows the use of cellulose, chitosan and their interpenetrating networks. Relevant drugs (e.g. antibiotics) will be incorporated in the aerogels physically (mixing, impregnation) and chemically (polysaccharide functionalization and grafting with cleavable links). The potential of bio-aerogels printed as drug-releasing wound dressings will be evaluated *in vitro* and, depending on the results, *in vivo*.

This highly interdisciplinary project will be carried out in two laboratories: (1) the Center of Materials Forming (CEMEF), which has significant expertise in the processing and forming of polymers, in particular bio-aerogels, and (2) the Institute of Biomolecules Max Mousseron (IBMM), which has extensive experience in the domain of medical devices and controlled release systems.

The thesis will be performed in the framework of the CNRS program *Thèse transverse* (transversal doctorate). The position is opened from October 2019 for three years.

Keywords: Gels, aerogels, biobased polymers, additive manufacturing, controlled drug release, wound dressings, polymer chemistry

Skills: Materials science, physical chemistry of polymers, chemistry, fluent in English

Duration: 3 years

Location: CEMEF (Sophia Antipolis) and IBMM (Montpellier), France

People involved and group info: Tatiana Budtova & Sijtze Buwalda (CEMEF, <http://www.cemef.mines-paristech>) / Benjamin Nottelet & H el ene Van den Berghe (IBMM-[Polymers for Health and Biomaterials](#))

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Please send your detailed CV, marks from the last two years of studies and at least two email addresses of reference persons.