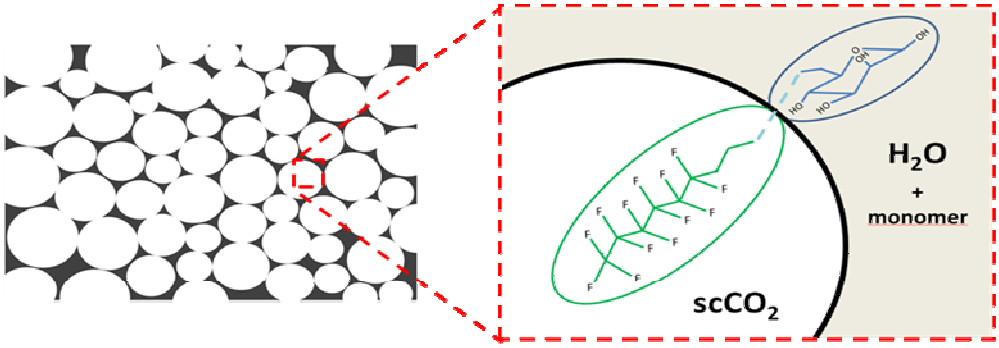
# USE OF NEW SURFACE ACTIVE CARBOHYDRATE ESTERS FOR THE SYNTHESIS OF POLYHIPES IN SUPERCRITICAL $CO_2$.

**Cédric Boyère[1], Audrey Favrelle[1], Alexandre Léonard[2], Bruno Grignard[1], Jean-Paul Pirard[2], Michel Paquot[3], Christine Jérôme[1*], Antoine Debuigne[1*]**

*[1] Center for Education and Research on Macromolecules, University of Liège. Chemistry Department, Sart-Tilman (B6a) 4000 Liège, Belgium; [2] Laboratory of Chemical Engineering, University of Liège, Sart-Tilman (B6a) 4000 Liège, Belgium; [3] Laboratory of Industrial Biological Chemistry, University of Liège. Gembloux Agro-Bio Tech (GxABT), 5030 Gembloux, Belgium.*

Porous polymer structures can be prepared by high internal phase emulsion (HIPE) polymerization. In these emulsions, the internal droplets phase exceeds 74% of the total volume and the monomer is located in the continuous phase. After polymerization, the removal of the droplet phase creates cavities in the polymer matrix. The resulting materials, called polyHIPEs,[1] exhibit highly interconnected voids and sustains a variety of applications such as scaffolds for tissue engineering[2], support for catalyst,[3] immobilization of proteins[4] etc. Interestingly, Cooper *et al.* reported the use of supercritical carbon dioxide ($scCO_2$) as an alternative to the traditional organic solvents for the synthesis of HIPE.[5] In this case, low molecular weight ionic perfluoropolyether (PFPE) surfactant was used to stabilize the water/$CO_2$ emulsion. In addition to be an inexpensive, non-toxic, non-flammable and environmentally friendlier medium, $scCO_2$ is easy to remove from the template since it reverts to gaseous phase upon depressurization.

In this work, we explore the use of novel non-ionic fluorinated modified carbohydrates as surfactants for the synthesis of polyHIPEs.[6,7] The hydrophilic head of the surfactant consists in a sugar moiety whereas the fluorinated tail has a strong affinity for the $scCO_2$ phase. The resulting acrylamide polyHIPEs were characterized by scanning electron microscopy, pycnometry and porosimetry. The impact of the surfactant on the porous polymer properties will be discussed. The synthesis of the surfactants will also be presented. A first approach consists in the enzymatic esterification of sugars by fluorinated acid derivatives.[6] Another strategy combines the selectivity of the enzymatic catalysis and the versatility of the thiol-Michael addition reaction.[7]




1. S. D. Kimmins and N. R. Cameron, *Adv. Funct. Mater.*, 2011, **21**, 211-225.
2. Y. Lumelsky, J. Zoldan, S. Levenberg and M. S. Silverstein, *Macromolecules*, 2008, **41**, 1469-1474.
3. I. Pulko, J. Wall, P. Krajnc and N. R. Cameron, *Chem. Eur. J.*, 2010, **16**, 2350-2354.
4. F. Fernández-Trillo, J. C. M. van Hest, J. C. Thies, T. Michon, R. Weberskirch and N. R. Cameron, *Adv. Mater.*, 2009, **21**, 55-59.
5. R. Butler, C. M. Davies and A. I. Cooper, *Adv. Mater.*, 2001, **13**, 1459-1463.
6. A. Favrelle, C. Boyère, P. Laurent, G. Broze, C. Blecker, M. Paquot, C. Jérôme and A. Debuigne, *Carbohydr. Res.*, 2011, **346**, 1161-1164.
7. C. Boyère, A. Favrelle, G. Broze, P. Laurent, K. Nott, M. Paquot, C. Blecker, C. Jérôme and A. Debuigne, *Carbohydr. Res.*, 2011, **346**, 2121-2125.