MAGNETO-RESPONSIVE AMPHIPHILIC POLYMER CONETWORK MICROCAPSULES

Clément Mugemana[a], Sebastian Ulrich[b], Federica Crippa[a], Philipp Lemal[a], David Moore[c], Alke Petri-Fink[a], André Studart[c] and Nico Bruns[a]

[a]Adolphe Merkle Institute, University of Fribourg, Chemin des Verdiers 4, 1700 Fribourg, Switzerland
[b]Empa, Swiss Federal Laboratories for Materials Science and Technology, Lerchenfeldstrasse 5, 9014 St. Gallen, Switzerland
[c]Complex Materials, Department of Materials, ETH Zürich, 8093 Zurich, Switzerland

ABSTRACT

Responsive microcapsules with the capability to respond under different stimuli are widely used in controlled released with the key feature of tuning the permeability of the polymeric shell in response to a well-defined stimulus.[1-2] Microcapsules that allow to remotely control their permeability in a magnetic field and to release their content upon exposure to a magnet could become useful for drug-delivery applications or for catalysis applications. Here we present microfluidically prepared microcapsules from amphiphilic polymer conetworks (APCNs). They present a new class of microcapsules with a shell composed of a three-dimensional network in which hydrophilic polymer chain segments are covalently linked to hydrophobic ones.[4] APCNs are known for their well-defined bi-continuous nanostructures that arise from incompatibility between the two polymer chains, leading to unique mechanical properties along with the ability to swell in aqueous as well as in organic solvents.[5] In order to render the microcapsules magneto-responsive, the shell of poly(*N*-isopropylacrylamide)-*linked by*-poly(dimethylsiloxane) microcapsules was loaded with superparamagnetic iron oxide nanoparticles[5] during the preparation of the APCNs. The local heating effect of the nanoparticles in an alternating field will impact the permeability of the microcapsules due to the collapse of the PNIPAM nanodomains.

References:

[1]De Cock, L.J.; De Koker, S.; De Geest, B.G.; Grooten, J.; Vervaet, C.; Remon, J.P.; Sukhorukov, G.B.; Antipina, M.N. *Angew. Chem. Int. Ed*. **2010**, 49, 6954.
[2]Xu, W.; Ledin, P.A.; Plamper, F.A.; Synatschke, C.V.; Müller, Axel H. E.; Tsukruk, V.V. *Macromolecules* **2014**, 47, 7858.
[3]Lu, B.; Tarn, M.D.; Pamme, N.; Georgiou, T.K. *J. Mater. Chem. B*, **2016**, 4, 3086.
[4]Bruns, N.; Scherble, J.; Hartmann, L.; Thomann, R.; Iván, B.; Mülhaupt, R; Tiller, J.C. *Macromolecules* **2005,** *38*, 2431.
[5]Monnier, C.A.; Lattuada, M.; Burnand, D.; Crippa, F.; Martinez-Garcia, J.C.; Hirt, A.M.; Rothen-Rutishauer, B.; Bonmarin, M.; Petri-Fink, A. *Nanoscale*, **2016**, 8, 13321; Park, J.; An, K.; Hwang, Y.; Park, J.G.; Noh, H.J.; Kim, J.Y.; Park, J.H.; Hwang, N.M.; Hyeoni, T. *Nature Materials* **2004**, 3, 891.