

Structural investigation of two pH-responsive block copolymers using synchrotron-SAXS

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Multi-responsive polymers have gained a lot of attention, mainly due to the huge array of applications [1] they can be used for, such as sensors, drug delivery systems or tissue engineering. In this work, core-shell micelles with a pH-responsive shell, whose shell blocks undergo a phase transition from expanded to collapsed as a response to changes on the pH, are investigated. At higher concentration, network formation is found, and the phase transition results in strong changes of the mechanical properties [2,3]. Here, we focus on the structural changes.

Two block copolymers were investigated in this work PMMA-b-PDMAEMA-b-PMMA (PMMA and PDMAEMA are poly(methyl methacrylate) and poly[2-(dimethyl amino) ethyl methacrylate]) and PMMA-b-PDMAEMA-b-P2VP-b-PDMAEMA-b-PMMA (where P2VP stands for poly(2-vinylpyridine)). Both block copolymers have similar architectures, ABA and ABCBA, with small hydrophobic blocks A in the outer part of the chain and large pH-responsive blocks B and C in the inner part. While PDMAEMA is a weak polycation, P2VP is a strong one and becomes hydrophobic at high pH values.

To study structural changes under different conditions, solutions of the polymers were prepared in D₂O at different concentrations (0.1-1 wt%) and pD values (1, 4 and 7). Synchrotron small-angle X-ray scattering experiments were carried out at the beamline D1 at CHESS to investigate the structure of the micelles.

References

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