Contribution ID: **51** Type: **Poster**

Thermal effects on nanoscale morphologies and chemical group vibrations of thermoresponsive double hydrophilic block copolymers in aqueous solutions

Wednesday 9 December 2020 17:40 (20 minutes)

Thermoresponsive double hydrophilic block copolymers exhibit great interest as model scaffolds for pharmaceutical applications due to their controlled potential in drug encapsulation and release. A thorough elucidation of the nanostructure of the formed self-assemblies and its evolution at different temperatures is mandatory to provide tailored design guidelines in targeted therapeutics. We present a summary on the investigation of the internal morphology for aqueous self-assembled nanostructures of novel double thermoresponsive PNIPAM-b-poly (oligo ethylene glycol methyl ether acrylate) (PNIPAM-b-POEGA) block copolymers by small angle neutron scattering (SANS). Our findings propose a distinct impact of chain-end groups on self-assembled morphologies, as well as on the interchain/intrachain interactions. The lower critical solution temperature (LCST) of these block copolymer solutions defines a transition crossover from hierarchical morphologies to well-defined nanoscale morphologies at temperatures above the LCST. Our scattering results are complemented by Fourier-Transform Infrared (FTIR) Spectroscopy. The combined FTIR and SANS data reveal that temperature-dependent vibrations of chemical moieties do not necessarily correlate to the analogous structural transitions at the nanoscale. Thereby, our study provides important insights into the morphology related to these thermoresponsive double hydrophilic block copolymer scaffolds for pharmaceutical applications.

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Session Classification: Joint poster session of MLZ User Meeting and DN2020

Track Classification: DN: Soft Matter