Contribution ID: **192** Type: **Poster**

Observing the structural evolution during chemical processes in-situ via SANS

Monday, 17 September 2018 17:45 (15 minutes)

The structures formed in self-assembling or self-organising systems can vary dramatically, and often non-linearly, depending on the processing conditions or as a result of external stimuli. In turn, these structural differences will often lead to pronounced differences in macroscopic properties and functionality. Optimisation of the functionality of such systems therefore entails increased control over the structure and consequently, a method of following the structural evolution during the synthesis or self-assembly process. To this end, we have developed a continuous-flow chemical reactor sample environment for SANS instruments, that enables uninterrupted observation of complex reactions with multiple reagents.

Results from two preliminary experiments will be presented: one following the morphological evolution of micellar aggregates formed in an aqueous solution of a commercial surfactant with continuously varying pH and the other, a block copolymer synthesis exhibiting polymerisation-induced self-assembly. Both experiments show the structural changes in unprecedented detail and demonstrate the capability of following self-assembly processes and chemical reactions *in-situ* on a SANS beamline. This is important as it expands the range of techniques available to probe complex soft-matter systems and opens the door to a variety of new measurements linking nano- and mesostructural phenomena to macroscopic properties.

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Session Classification: Poster session 1

Track Classification: P1 Instrumentation and methods