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Faster Kinetics followed by SANS

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Upgrade of KWS-1
Science Case
In the past, the exchange kinetics of polymers between different polymer micelles have been resolved using SANS. The option of selective deuteration has a huge potential to look at any exchange process in the future. Usually, one starts with two differently labelled, but otherwise structurally the same entities that by the time exchange their building blocks and, therefore, lose the contrast between them. The science field is now moving to smaller molecules like lipids that have much faster exchange kinetics than the slow polymers. Therefore, experimentally shorter time scales have to become accessible for kinetic measurements.
Apart from kinetic measurements, even in static measurements, one wants to measure much faster in order to explore a larger parameter space at a given time. The results will be fed to industrial optimization processes that often are supported by artificial intelligence that even require much more experimental data.
One prominent example of the past is the Covid vaccine using mRNA embedded in lipid particles. Here, one needed to study the drug delivery processes and the ideal compositions (with many more ingredients). So, lipids as formulation component and as interacting material are becoming more and more important for the industry.
Technical realization
To follow kinetic processes using SANS, the provided intensity if often not enough. One either has to perform a lot of repetitions or is limited to rather short times (~10s+) in a single shot experiment. Therefore, it highly important to optimize the beam preparation section of an instrument (including the velocity selector and the collimation) and maximize the detector area (for optimal data collection).
Beam preparation part will already be tackled in the course of 2023 on internal funding including a tilt option for the selector for 20% wavelength spread and an exchangeable beam stop to allow for sample apertures of 2.5 x 2.5 cm2 (instead of 1 x 1 cm2). The intensity gain will be 2 x 6 = 12.
The remaining portion is the extension of the detection area by implementing a near-field detector with a hole in the centre for the small-Q information. This additional detector will cover an area of 1 x 1m2 and, therefore, will allow for an approx. 2-fold higher detection of neutrons.

Primary author: FRIELINGHAUS, Henrich (JCNS)

Presenter: FRIELINGHAUS, Henrich (JCNS)

Session Classification: Large scale structures