Experimental report

02/03/2021

Proposal: 9-10-1631 **Council:** 10/2019

Title: SANS study of anisotropic hollow microgels in crowded environments

Research area: Soft condensed matter

This proposal is a new proposal

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Samples: [C6H11NO]n
[C6D7H4NO]n

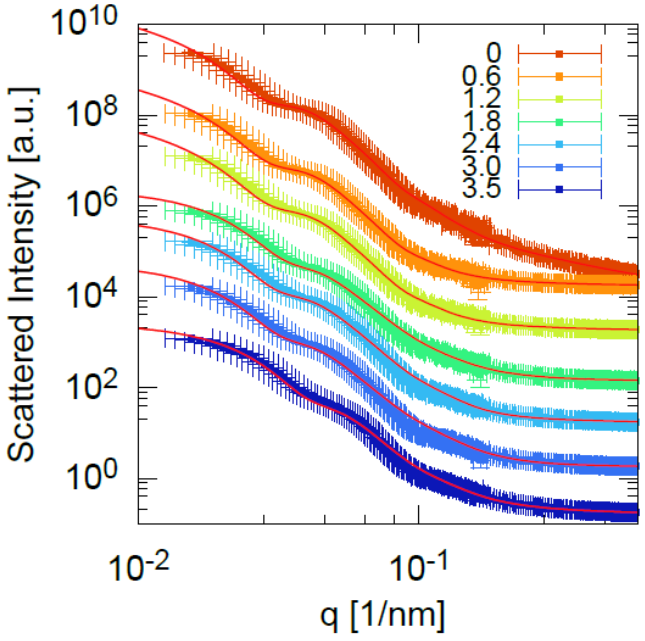
Instrument	Requested days	Allocated days	From	To
D11	3	2	21/09/2020	23/09/2020

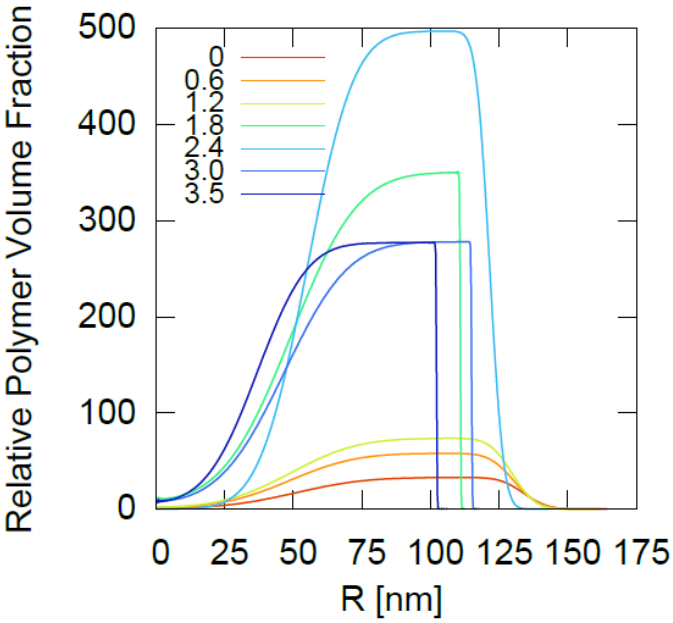
Abstract:

We are able to synthesize elliptically shaped hollow microgels of 540 nm x 270 nm (obtained with TEM) with a feed and seed precipitation polymerization. To study their shape and size, scattering experiments are needed. As microgels are interesting candidates for medical applications (e.g. tissue engineering, drug delivery), their behavior in crowded environment has to be studied. Small angle neutron scattering and the possibility to perform contrast variation experiments, allows to directly study the shape and size of ellipsoidal hollow microgels when the surrounding is matched with the solvent. Hence, we would like to study elliptically shaped microgels in two different environments consisting of a matrix of (i) spherical deuterated microgels and (ii) elliptically hollow deuterated microgels. This will give insides about the deformation, deswelling or interpenetration of elliptically shaped microgels in these two matrixes.

RESULTS SANS DATA ANISOTROPIC MICROGELS IN A MATRIX OF SPHERICAL MICROGELS

Small angle neutron scattering data of anisotropic hollow microgels in a matrix of deuterated 'normal' spherical microgels show a change in shape and size when the concentration of the matrix is increased. Below the concentration of 1.8wt% (0, 0.6, 1.2 wt%), the anisotropic microgels are elongated and have an ellipsoidal character. The scattering data is fitted with a one shell ellipsoidal microgel model with a reasonable fixed polydispersity (15 %). The CHI² values of around 10 show a good quality for all three fits. When looking at the aspect ratio, the anisotropic character is decreased with increasing concentration of the spherical matrix. This effect is even larger at concentrations above 1.2 wt%, the elliptical microgels are squeezed within a spherical matrix and the aspect ratio decreases to 1 while the polydispersity needs to be increased. Furthermore the quality of the fits (CHI²) increases, meaning that especially the fits in the intermediate regime at 2.4 wt% and 3.0 wt% are worse. When a matrix concentration of 3.5 wt% is reached the quality of the fit is increased again as CHI² decreases. As a result, I would claim that the small angle neutron scattering data show an intermediate state, where the anisotropic microgels are embedded in a spherical ordered structure with properly different sizes and shapes. When the matrix concentration is increasing to 3.5 wt% an 'equilibrium' state is reached, where the anisotropic microgels are compressed in such a way that they are uniformly in size and there is less free space to have different shapes/sizes within the spherical matrix.





sample	Aspect Ratio	polydispersity	CHI²
0	5.3	15	12.9
0.6	3.2	15	6.8
1.2	2.6	15	8.65
1.8	1.0	23	11
2.4	1.0	22.8	36.1
3.0	1.1	22.74	49.6
3.5	0.94	21.41	29.5