Experimental report

11/02/2025

Proposal: 9-11-2133 **Council:** 4/2023

Title: Oppositely charged microgels in crowded environment, a SANS with contrast variation study

Research area: Soft condensed matter

This proposal is a new proposal

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Samples: pNIPAM microgel suspension in D2O/H2O

Instrument	Requested days	Allocated days	From	To
D22	2	1	13/09/2023	14/09/2023

Abstract:

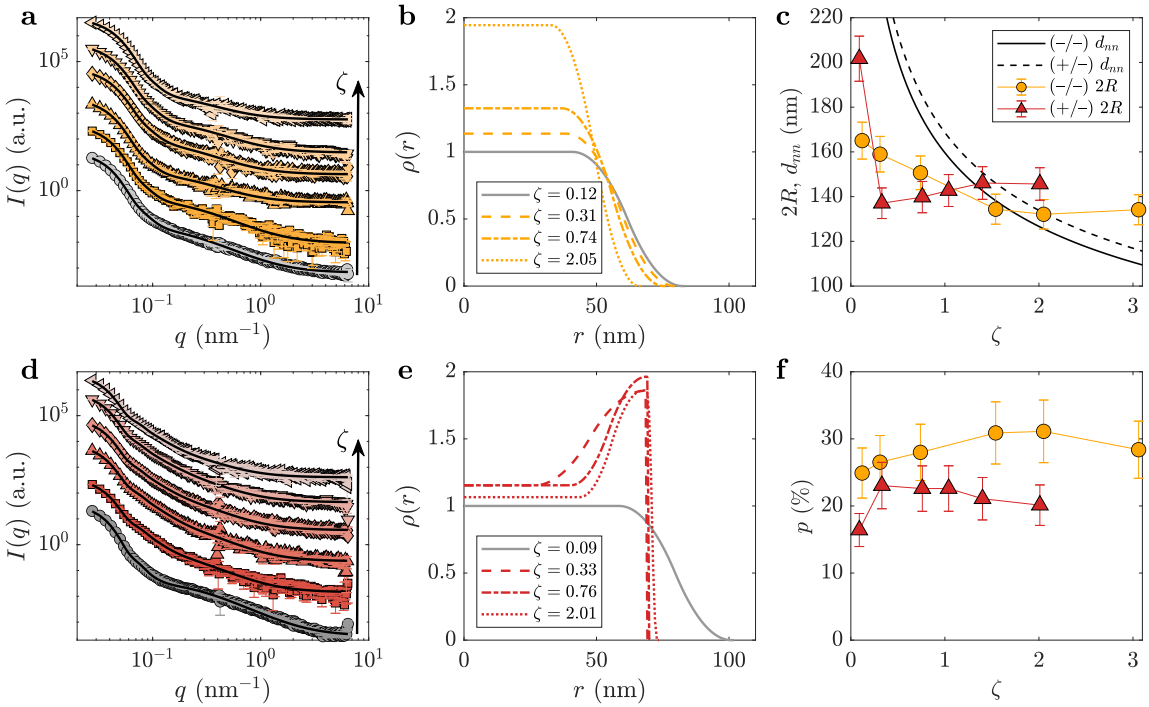
Microgels are soft and responsive particles that can deswell or deform in response to increasing their concentration in suspension. Deswelling is governed by their counter-ion clouds and, therefore, is particularly strong for highly charged ionic microgels. In this proposal, we want to use SANS with contrast variation to study the form factors of individual charged microgels in a matrix of oppositely charged microgels. The results can have important implications for a better understanding of the self-assembly of ¿smart¿ functional materials based on oppositely charged microgels. Furthermore, our systematic investigation might shed light on contrasting report on the response of individual nanogels in crowded environment reported in the literature.

Report on experiment 9-11-2133

Here, we investigate the response of a few charged microgel particles (``defects'') embedded in a matrix of oppositely-charged but otherwise identical microgels at low ionic strength. Poly-N-isopropylacrylamide) (pNIPAM) microgels with a low degree of crosslinking (2-3 mol%) and a high charge density (10 mol% charged co-monomer) are used to maximize the effects of electrostatics on their deswelling or deformation.

As a comparison, suspensions of identical similarly-charged microgels are used. We perform small-angle neutron scattering (SANS) with contrast variation to directly measure the changes in the form factor of the ``defects''.

By changing the packing fraction of the matrix microgels, we study the interplay between electrostatic attraction and crowding from the perspective of a single charged microgel. We observe strong deswelling in the oppositely-charged mixtures, which differs from that of the similarly-charged ones in the magnitude, localization (core vs. shell) and dependence on crowding.



The figure shows two examples of the collected data. As can be seen the majority of deuterated microgels is perfectly matched. The solid lines are fit of the data with a fuzzy sphere model. From the fits we obtains information on the radial profile of the microgels (central panels) and the trend of the apparent size polydispersity.

These data are part of a manuscript we will submit in the next two weeks.