Experimental report

15/02/2021

Proposal: 9-12-464 **Council:** 4/2016

Title: Structure of ligand self-assembledmonolayers at the surface of quantum dots and Nanoplatelets in solution

Research area: Soft condensed matter

This proposal is a new proposal

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Local contacts: Isabelle GRILLO

Samples: CdSe nanoparticle dispersion

Instrument	Requested days	Allocated days	From	To
D11	1	0		
D22	1	0		
D33	1	2	08/10/2016	10/10/2016

Abstract:

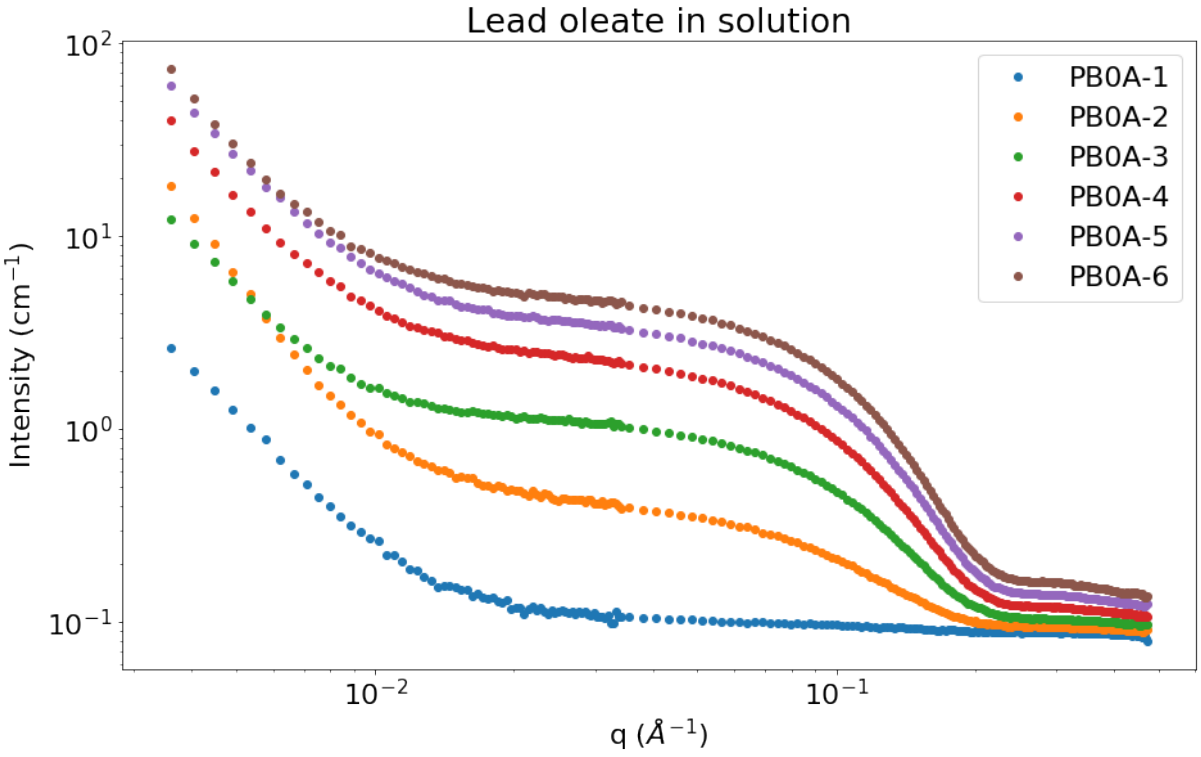
Quantum dots and platelets are a class of materials with great application promises and their self-assembly is a current subject of intense research. Hence, a better fundamental understanding of inter-particle interactions is a key challenge. An important component of inter-particle interaction is due to the surfactant coating of the nanocrystals. The density of the brush, the way the ligands self-assemble on the particle is thought to have an important effect on the short-range interaction between the nanocrystals. However, this interface is to date very poorly known since quantitative structural information is very difficult to obtain in solution. Here our aim is to use SANS to characterize the structure of the ligand brush and the nanoparticle/solvent interface. By using contrast variation between an hydrogen/deuterium organic solvent, a hydrogenated ligand and the particle we will measure the ligand brush thickness and density as a function of the particle shape (spheres or 2D platelets) and size. We will also quantify the degree of solvent penetration in the ligand brush, yielding an unprecedented view of the nanoparticle/solvent interface in solution.

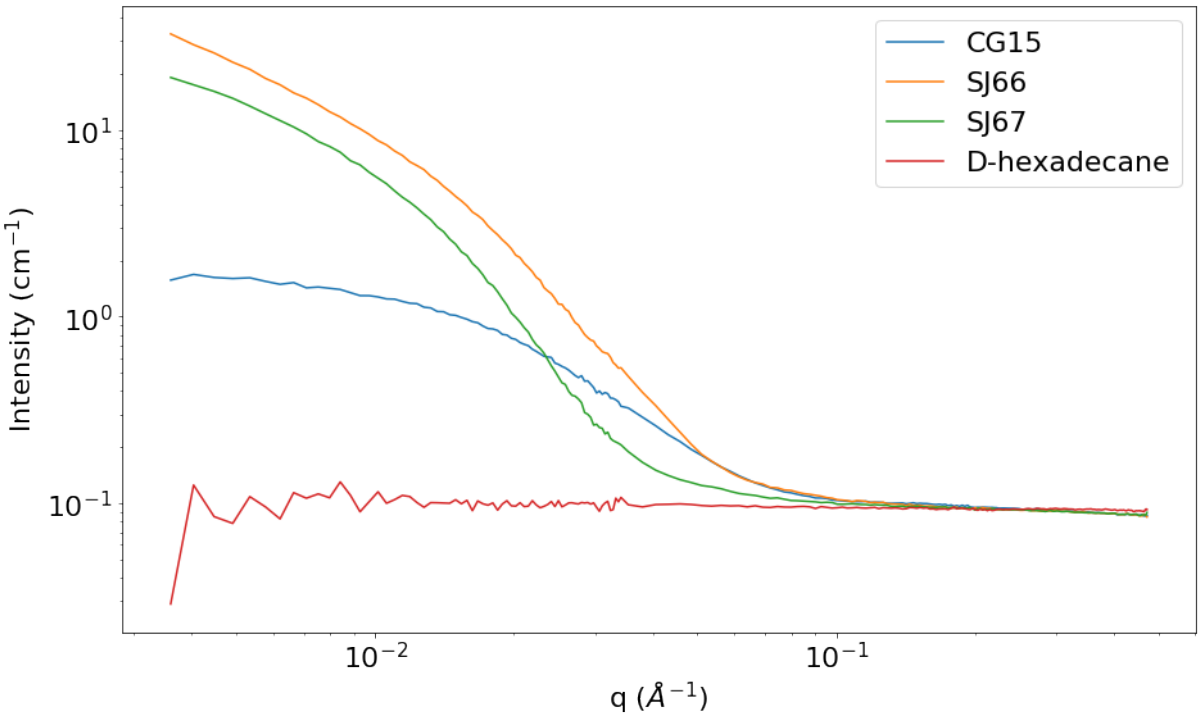
Preliminary Experimental report for 9-12-464 proposal

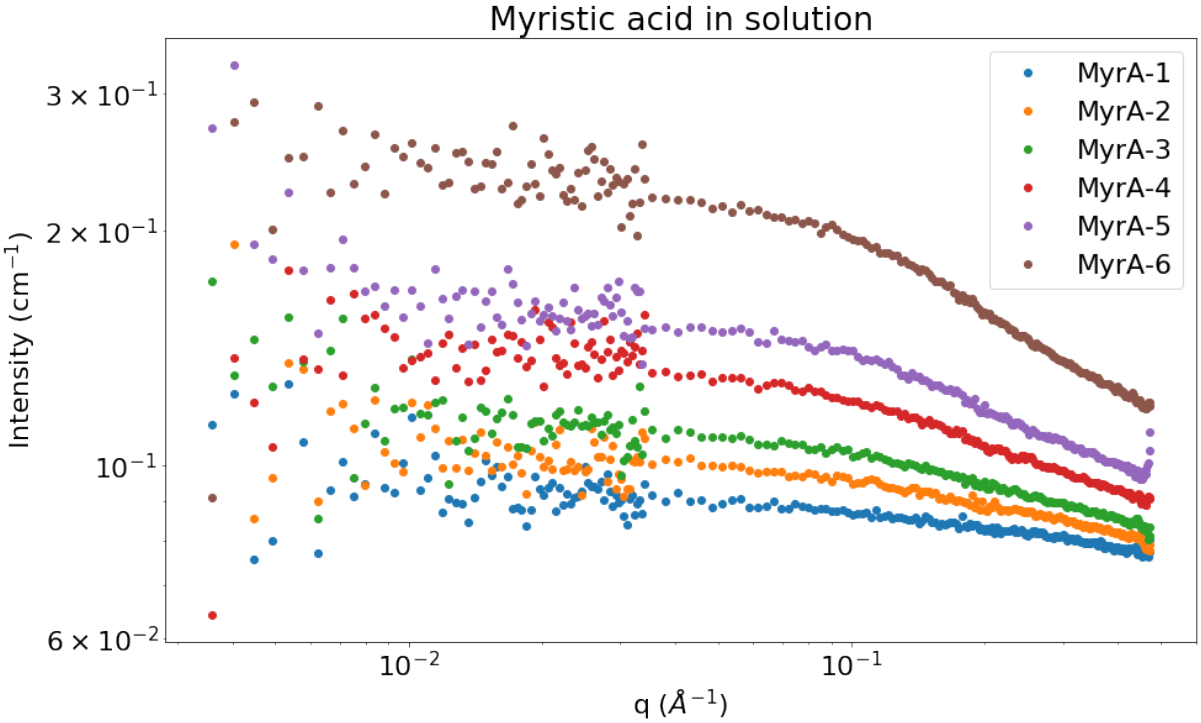
Date of experiment : 8/10/2016 to 10/10/2016
Beamline : D33
Number of days allocated : 2
Local contact: Isabelle Grillo
Experimenters: B. Abécassis, N. Castro, S. Jana.

The beam time went very well with perfect operation of the D33 instrument. Two wavelengths were used (6 Å and 13 Å) and 3 sample to detector distances: 2, 5 and 12 meters.

A total of 60 samples' SANS patterns were recorded including 3 differents CdSe quantum dots, CdSe nanoplatelets and different precursors and surfactant.
Below are a few examples of SANS patterns that are currently being treated.







The lead oleate scattering patterns have been used in the context of an in situ of study of PbS nanocrystal nucleation and growth since it is one of the precursors of the synthesis. The corresponding data are shown in a paper which will be submitted in the coming weeks.