Experimental report

11/02/2025

Proposal: 9-10-1768 **Council:** 4/2023

Title: Determination of the position of azobenzene-modified silica particles at air-liquid interface using neutron reflectometry

Research area: Soft condensed matter

This proposal is a new proposal

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Samples: azobenzene-modified silica particles

Instrument	Requested days	Allocated days	From	To
FIGARO	2	2	04/12/2023	06/12/2023

Abstract:

The possibility to destabilise a stable emulsion on demand is pivotal for their formulations in many industrial applications. Recently, we develop an innovative light-responsive water/oil Pickering emulsion based on azobenzene-modified silica particles as the stabiliser. A key aspect that must be known is where the particle sits at the interface. This will allow us to predict a-priori which kind of emulsion (oil-in-water or vice-versa) and how stable it will be. Since the particle adsorption and its position with respect to the interface depends on the irradiation light, it is pivotal to probe it in-situ. This makes most of the available techniques not suitable since they all require the deposition and treatment of the particles. Here we propose to use neutron reflectometry to access the particle position at air-water and air-oil interfaces. We will perform measurements at different contrasts and fit the data with model based on a combination of slabs, Gaussian and Log-normal curves.

Report on experiment 9-10-1768

We used neutron reflectometry (NR) to characterise the structure at the interface of silica (SiO_2) particles functionalized with light-responsive azobenzene (AB-SiO2) and arylazopyrazole (AAP-SiO2) chromophores anchored with an 11-carbon chain ($AzoO(CH_2)_{11}OH$)). This study was motivated by the fact that, while AB-SiO2 stabilised emulsions undergo a reversible transition from w/o emulsions to separated oil and water phases, the analogous AAP-SiO2 stabilised emulsions, whilst having a very similar structure and photoisomerisation, do not. These differences are believed to be due to the particle wettability, indicated by the position the SiO2 core occupies with respect to the oil/water interface, i.e. the contact angle. We menage to collect only preliminary data that however show different trend depending on sample and irradiation, Fig.1. these data are currently under evaluation.

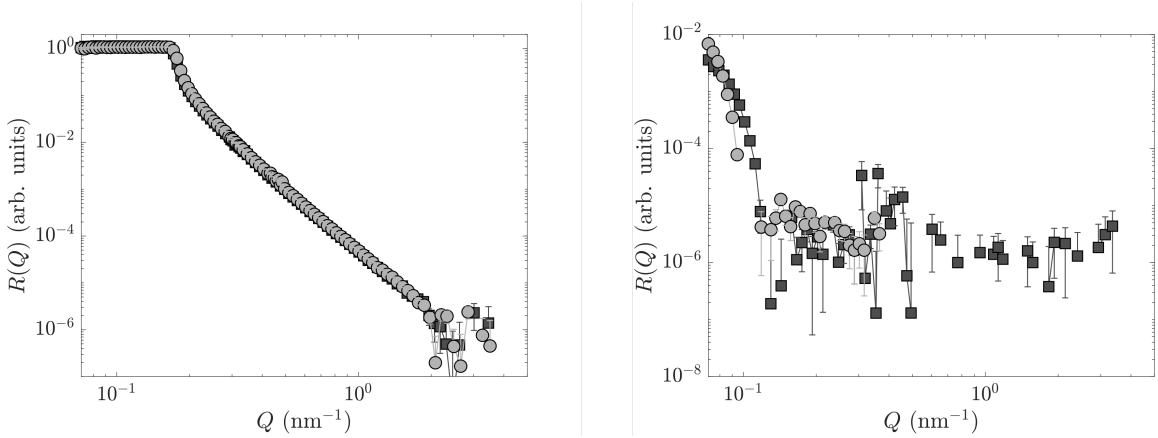

Fig. 1 Silica particles at the D2O (left) and air contrast matched water interface (right). Different symbols correspond to different irradiation.