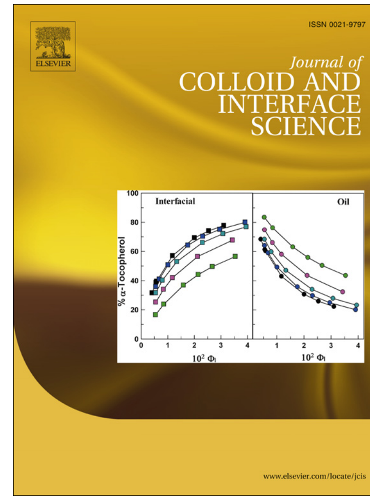
Accepted Manuscript



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PII: S0021-9797(15)00175-7
DOI: http://dx.doi.org/10.1016/j.jcis.2015.02.019
Reference: YJCIS 20253

To appear in: *Journal of Colloid and Interface Science*

Received Date: 18 December 2014
Accepted Date: 6 February 2015

Please cite this article as: Y. Zeng, S. Schön, R.v. Klitzing, Silica nanoparticle suspensions under confinement of thin liquid films, *Journal of Colloid and Interface Science* (2015), doi: http://dx.doi.org/10.1016/j.jcis.2015.02.019

Silica nanoparticle suspensions under confinement of thin liquid films

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Abstract

The paper deals with the effect of geometrical confinement on the structuring of Silica nanoparticle suspensions in thin films. The confinement is produced by a Colloidal Probe AFM. Approaching of the two outer surface leads to oscillatory forces. The force profile reflects the pair correlation function and its period the average distance between the nanoparticles under confinement. The nanoparticle structuring is compared to the particle distribution in bulk by small angle x–ray scattering (SAXS). The SAXS structure factor which presents the Fourier transform of the pair correlation function gives the same interparticle distance for the bulk as the oscillation period of the AFM force curves. The distance scales with particle number density ρ as $\rho^{-1/3}$ and is very robust against different suspension parameters (nanoparticle size, ionic strength) and parameters of the outer surfaces (surface potential, roughness and elasticity).

1 Introduction

Stability of colloidal systems such as foams, emulsions and suspensions has a tremendous impact on our daily life affecting a large variety of products such as food, washing detergents and personal care products. They are also very important for industrial processing such as lubrication, coatings, oil recovery or even radioactive waste disposal [1]. All of these systems consist of gaseous, liquid or solid colloidal particles in a continuous liquid medium. The liquid medium forms a thin film between two neighboured particles. The stability of these thin films is the decisive factor preventing coagulation or aggregation of the colloidal particles and thus determining the overall stability of the corresponding macroscopic system. Thin films therefore provide an ideal model system for investigation of the macroscopic systems on a microscopic scale.
The film stability is governed by van der Waals and electrostatic forces which is summarized in the DLVO theory. Both are long range forces and can act over several

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