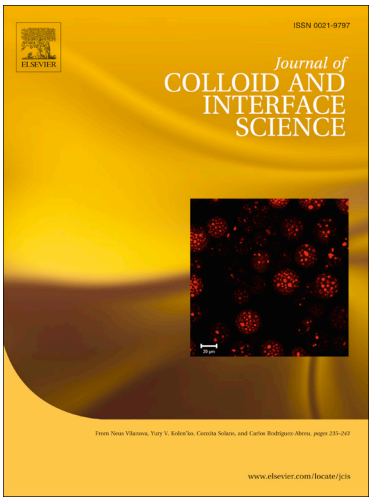
Accepted Manuscript



The rheology of polyvinylpyrrolidone-coated silica nanoparticles positioned at an air-aqueous interface

Kai Yu, Huagui Zhang, Simon Biggs, Zhenghe Xu, Olivier J. Cayre, David Harbottle

PII: S0021-9797(18)30550-2
DOI: https://doi.org/10.1016/j.jcis.2018.05.035
Reference: YJCIS 23613

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

Received Date: 7 April 2018
Revised Date: 9 May 2018
Accepted Date: 14 May 2018

Please cite this article as: K. Yu, H. Zhang, S. Biggs, Z. Xu, O.J. Cayre, D. Harbottle, The rheology of polyvinylpyrrolidone-coated silica nanoparticles positioned at an air-aqueous interface, *Journal of Colloid and Interface Science* (2018), doi: https://doi.org/10.1016/j.jcis.2018.05.035

The rheology of polyvinylpyrrolidone-coated silica nanoparticles positioned at an air-aqueous interface

Kai Yu[1], Huagui Zhang[1], Simon Biggs[2], Zhenghe Xu[3], Olivier J. Cayre[1], and David Harbottle[1*]

[1] School of Chemical and Process Engineering, University of Leeds, UK

[2] School of Chemical Engineering, The University of Queensland, Australia

[3] Department of Chemical and Materials Engineering, University of Alberta, Canada, and Department of Materials Science and Engineering, Southern University of Science and Technology, Shenzhen, China

ABSTRACT

Particle-stabilized emulsions and foams are widely encountered, as such there remains a concerted effort to better understand the relationship between the particle network structure surrounding droplets and bubbles, and the rheology of the particle-stabilized interface. Poly(vinylpyrrolidone) coated silica nanoparticles were used to stabilize foams. The shear rheology of planar particle-laden interfaces were measured using an interfacial shear rheometer and the rheological properties measured as a function of the sub-phase electrolyte concentration and surface pressure. All particle-laden interfaces exhibited a liquid-like to solid-like transition with increasing surface pressure. The surface pressure-dependent interfacial rheology was then correlated to the formed micron-scale structures of the particle-laden interfaces which were imaged using a Brewster angle microscopy. With the baseline knowledge established, foams were prepared using the same composite particles and the particle network structure observed using cryo-SEM. An attempt has been made to correlate the two structures observed at a planar interface and that surrounding a bubble to elucidate the likely rheology of the bubble stabilizing particle network. Independent of the sub-phase electrolyte concentration, the resulting rheology of the bubble stabilizing particle network was strongly elastic and appeared to be in a compression state at the region of the L-S phase transition.