The impact of nano-ions on non-ionic surfactant foam properties

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ABSTRACT

Ion foam flotation is a promising method to extract, separate and concentrate metal ions at environmentally friendly conditions as it can be deployed at low temperatures and does not necessitate high solvent volumes compared to other commercial extraction methods such as liquid/liquid extraction. Usually, the metal ions interact electrostatically with the charged water/air interface within the foam using an ionic foaming agent with opposite charge. Herein, a non-ionic foaming agent will be employed, as unlike classical metal ions, nanometer-sized ions were recently found to adsorb to neutral hydrated surfaces, such as non-ionic surfactant micelles, with very strong affinities driven by the so-called superchaotropic effect. The resulting non-ionic foams (in absence of nano-ions) and partially charged foams (nano-ions adsorbed) were investigated microscopically using small angle neutron scattering (TOF-SANS) and macroscopically using a FOAMSCAN setup. Upon nano-ion adsorption, it was observed that the foam films became thicker and better defined due to arising electrostatic repulsions between the film borders. The same observation was made in the presence of small amounts of the ionic surfactant SDS and the effect could be reverted upon addition of electrolyte, confirming the electrostatic nature of the effect. Simultaneously, significant alterations of the foaming ability, drainage and stability were observed, which are probably linked to the microscopic observations made in SANS. First insightful results have been obtained but need further investigation in the following weeks.

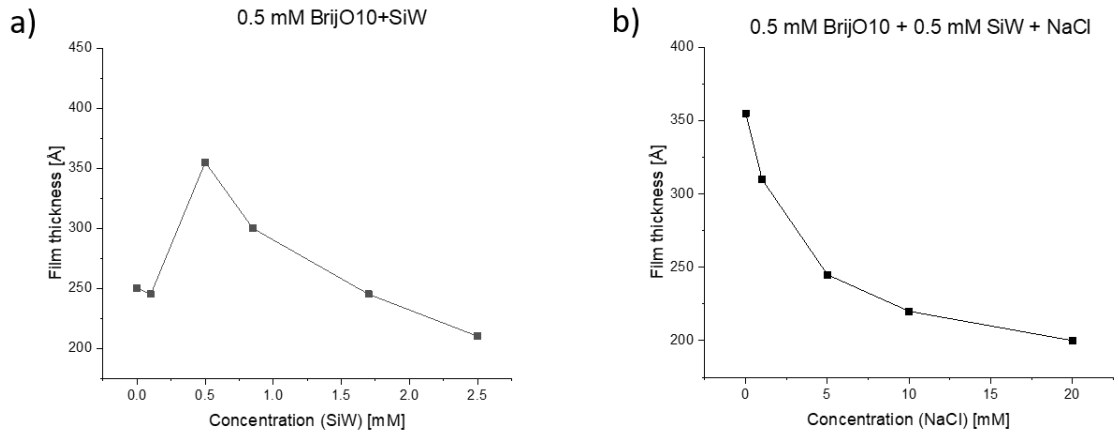

Figure 1: Evolution of film thickness of a quasi-stationary foam of the non-ionic surfactant Brij O10 obtained from SANS: a) Effect of the nanometric polyoxometalate SiW ($H_4SiW_{12}O_{40}$) on the film

thickness and b) Effect of the electrolyte NaCl on the film thickness for a quasi-stationary Brij O10 foam loaded with 0.5 mM SiW.