Surfactants, Solvents & Silica: Probing self-assembly in solution

Karen J Edler,[1*] Emelie Nilsson,[2] Viveka Alfredsson,[2] Olle Söderman,[2] Daniel Bowron.[3]
[1] Department of Chemistry, University of Bath, Claverton Down, Bath, BA2 7AY, UK
[2] Physical Chemistry, KILU, Lund University, P.O. Box 124, SE-22100 Lund, Sweden
[3] ISIS, Science and Technology Facilities Council Rutherford Appleton Laboratory, Harwell Oxford, Didcot OX11 0QX, UK

The self-assembly of surfactant micelles is important in many applications from controlling the rheology and cleaning properties of personal care products to templating pore structures in inorganic materials. The size and shape of cationic micelles can be controlled via their interaction with their soluble counter-anions, and this is well known to affect properties such as the critical micelle concentration. However, although the bulk properties of such solutions have been studied using a range of techniques including conductivity and small angle scattering, it is difficult to directly measure the interactions between the surfactant headgroups and ions in solution. Much of the literature description of these systems is therefore inferred from these bulk measurements. We have used wide angle neutron scattering on solutions of decyltrimethylammonium cations, which have been ion exchanged to contain a range of counteranions, along the Hofmeister series, to directly probe interactions in these systems. The data was modelled using Empirical Potential Structure Refinement (EPSR) to study the association between the different counterions and the micelle surfaces and how this affects micellar structures in these systems.