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Deuterated Aerosol OT: My favourite molecule for neutron scattering

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The surfactant sodium dioctylsulfosuccinate (Aerosol OT or AOT) is used widely, due to its versatility. It is soluble in water and in oils, and it is surface activity and can act as an emulsifier. There are hundreds of papers and patents every year that feature it. This amount of research provides ample opportunities to study AOT-containing formulations using scattering. Aerosol OT is hydrocarbon, so isotopic contrast from neutron scattering is ideal for studying it. It often appears in complex formulations where it is valuable to differentiate between the surfactant and other components. These are the times where the deuterated analogue of AOT, in particular, is useful for gaining information through neutron scattering experiments.

My interest in Aerosol OT is as a charging agent for colloids in nonpolar solvents. This is due to its dual ability to form inverse micelles, which act as a charge screening background electrolyte, and also to interact with colloids, which introduces an ionisable species to an otherwise uncharged particle. Over the last decade, small-angle neutron scattering (SANS) measurements of the binary system of deuterated AOT and hard-sphere PMMA latexes in latex contrast-matched alkane solvent have helped reveal how AOT charges particles in nonpolar media. The best mechanism to consistently explain these data is that the deuterated AOT surfactant is located throughout the whole of the latexes, absorbing inside the particle rather than adsorbing at the interface.

The key measurements to demonstrate this were performed with Isabelle Grillo on D11 at the ILL. Since we first reported this absorption model, I have used deuterated AOT and PMMA latexes to address other questions about the system. Is the distribution of AOT surfactant different to other colloids in nonpolar solvents? How can we modify the surfactant to make it a more effective charging agent? Can the surfactant reservoir be depleted if the particle concentration is increased? I will discuss how I have used deuterated AOT and give my perspective on future plans for using it in the areas of colloid and soft matter science.

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