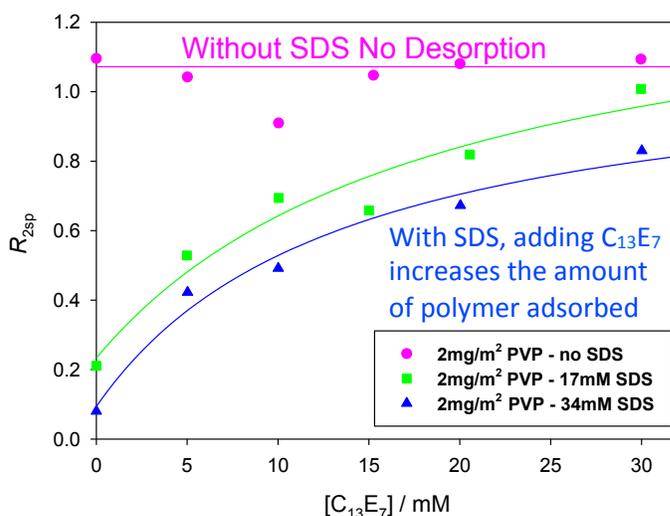


Using NMR Relaxation to Study Mixed Surfactant Systems

Surface-active agents (surfactants) are ubiquitous to a wide variety of industrial, cosmetic and pharmaceutical products. Living systems make use of naturally occurring surfactants such as lecithin and phospholipids. Surfactant mixtures enhance performance in comparison with individual components. Understanding the structure and properties of mixed micelles containing, for example anionic and non-ionic surfactants, is essential to optimize product performance. Mixed surfactants may form aggregates that are substantially different (more fluid-like, or solid-like, in behavior) than either of the single, pure surfactant aggregates. Many industrial formulations such as detergents, paints, foodstuffs and cosmetics contain both surfactants (single and mixed) and polymers. Their interactions govern many of the properties of suspensions.

NMR solvent relaxation can be used to study the interactions that can occur between surfactant-polymer complexes and their adsorption at a particle surface. Two different surfactants were added to an aqueous dispersion of a silica containing a fixed concentration of a water-soluble polymer (polyvinylpyrrolidone, PVP). The surfactants were an anionic (sodium dodecylsulfate, SDS) and a nonionic (an alkylpolyethoxylated, $C_{13}EO_7$). Adsorption of a component at the particle surface increases the specific relaxation rate R_{2sp} of the dispersion.

In the absence of any surfactant, the amount of PVP adsorbed onto the silica particle surface is high (R_{2sp} of approx 0.4). Addition of the nonionic surfactant alone has no effect on this total amount of the PVP adsorbed (red •). Adding SDS alone to the silica dispersion results in *desorption* of PVP (see also XiGo Application Note 122); increasing the SDS concentration from 17mM to 34mM increases the amount desorbed (R_{2sp} of approx 0.12 and 0.05 respectively). However, subsequent addition of the nonionic causes *re-adsorption* of the PVP and the lower the SDS concentration, the greater is the effect of the added nonionic (green • and blue •).



B. Cattoz, T. Cosgrove, M. Crossman, and S. W. Prescott. Surfactant-mediated desorption of polymer from the nanoparticle interface. *Langmuir*, 28(5):2485–2492, 2012.