

## Low surface energy materials (LSEMs) from new hydrocarbon architectures

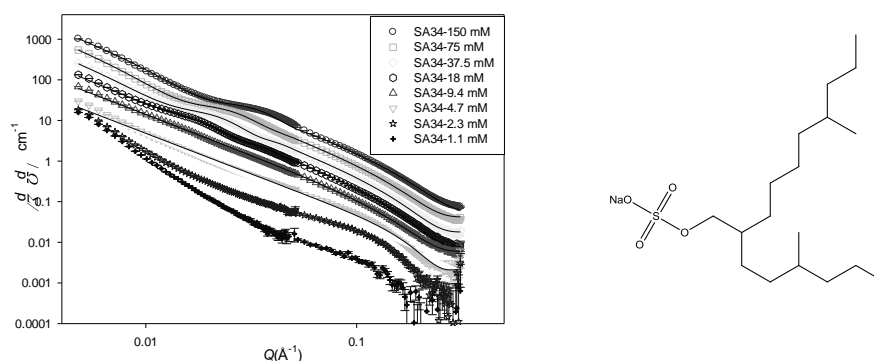
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Low surface energy materials (LSEMs) are obtained by attachment of surface layers to substrates. The cause of low surface energy is the underlying chemical structure of the interfacial layers: the ability to control surface properties being the direct consequence of chemical structure. There are numerous applications of LSEMs today, such as printing, painting, emulsification/suspension (medical, packaging, etc.), washing antifogging and repellent surfaces (self-cleaning windows, anti-snow, anti-fog surfaces, fibers, etc.).

Therefore, development and optimization of LSEMs has attracted much attention, and a wide variety of useful LSEMs can be obtained by Fluorinating surfaces. Unfortunately, this has dramatic environmental consequences because of the persistence and bioaccumulation of Fluorocarbons (FCs). Therefore, new surfactants have been synthesised using commercially-available Hydrocarbon (HC) compounds with various low surface energy hyperbranched “hedgehog” tails to establish the best substitutes for FCs and to explore how surfactant chain length and branching affects adsorption at the air-water interface

Adsorption/self-assembly behavior of these surfactants (linear and branched, single chain and double chain of  $C_{18}$  surfactants) were studied by tensiometry  $\gamma$ , and small angle neutron scattering (SANS). A comparison of the individual cmc's shows that they follow the expected general trend of decreasing cmc with increasing effective chain length (i.e., the length of the longest linear portion of the chain only). However, because the surfactants differ in terms of degrees of chain branching, the exact relationship between the cmc and the alkyl chain length is more indirect. Analyses of tensiometric data indicate the subtle structural modifications in the tails (branching), feed through to significant effects on surface tension of complete monolayers. Higher branching factor and closeness of the branch to the head group promotes an effective surface tension reduction and an increase in the effective molecular area, while increase in the number of chains reduces solubility of the surfactants in aqueous solutions.

A structural study of these surfactants at a range of concentrations using SANS revealed the formation of spherical micelles with radius of about 10-12 Å for the double chain surfactants in non-aqueous solutions and multi-layered lamellar structure for the single chain surfactants in aqueous solutions (Fig.1).



**Fig. 1:** SANS from a branched single chain  $C_{18}$  surfactant in various concentrations in  $D_2O$ . Solid lines are fits to the lamellar structure.