

Lecture-08-Meso Scale Fabrication Approaches and Self Assembly

8.1. What are the different types of surfactants? Give one example of each type.

Ans: Surfactants are special class of molecules that have spaitail variation in prpperties. It is well know that a surfactant molecule is typically composed of a “hydrophobic” (organice) tail and a “hydrophilic” (inorganic) head. The "tail" part of most surfactant molecules is fairly similar, consisting of a hydrocarbon chain, which can be branch, linear, or aromatic. Most commonly, surfactants are classified according to polar head groups. A surfactant molecule can be of 4 types: Non – ionic, Ananionic, Cataionic and Zwitter ionic.

A non-ionic surfactant has no charge groups in its head. The head of an ionic surfactant carries a net charge. If the charge is negative, the surfactant is more specifically called anionic; if the charge is positive, it is called cationic. If a surfactant contains a head with two oppositely charged groups, it is termed zwitter ionic surfactant.

Following are examples of some common surfactant molecules.

Anionic: Sulfate, sulfonate, and phosphate esters. Common Example: **SDS** (Sodium Do-decyl Sulfate)

Cationic: pH-dependent primary, secondary, or tertiary amines, permanently charged quaternary ammonium cation. Common Example: **CTAB** (Cetyl trimethyl ammonium bromide).

Zwitter ionic: cocamidopropyl hydroxysultaine.

8.2. How a dirt particle is detached from a surface due to the action of a detergent?

Ans: A surfactant molecule has both hydrophilic head and hydrophobic long tail whereas dirt is generally hydrophobic. The hydrophilic end attaches to water molecule whereas hydrophobic tail attaches to dirt particles. When water flows, this dirt particle is detached from the surface along with water hence cleaning the surface.

8.3. What is meant by “top-down” fabrication methods?

Ans: A top-down approach essentially implies fabricating a specific component by shaping a large block of material. In fact, a large monolith statue cut out from a single piece of rock is a classic example of top down fabrication technique.

In the context of meso scale fabrication technique, Photo lithography is regarded as a “top Down” technique, as it involves “etching” of some part of the film, after exposure. To maintain analogy with Photo lithography, other Soft lithography techniques are also classified as “Top down” patterning methods, though in true sense they do not involve removal of materials.