Surface active silica sols

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Hydrophobically modified silica particles are often used for stabilizing emulsions. Particles can position themselves at the oil/water interface, thereby acting to prevent droplet coalescence. Such emulsions are known in the art as Pickering emulsions. They are very stable due to the adsorption of particles (which are usually not amphiphilic) at the interface between the continuous and the dispersed phases, providing a barrier to prevent droplet coalescence and phase separation.

Plain silica nanoparticles lack the driving force for the oil-water interface that normal surfactants have. By making them amphiphilic by attaching both hydrophilic and hydrophobic moieties, the nanoparticles have a tendency to accumulate at interfaces, just as standard surfactants have. Once at the interface they act as stabilizers of the emulsion, as demonstrated by Pickering long ago.

In this work new hydrophilic modifiers based on polyethylene glycol (PEG) of various sizes have been synthesized as illustrated below by reacting 3-glycidoxypropyltrimethoxysilane end capped PEG.

These modifiers have been used in combination with trimethoxyisobutyl silane to derivatize silica sols and obtain amphiphilic particles. After purification, the particles have been characterized by thermogravimetric analysis.

The surface activity of the modified colloidal dispersions has been evaluated at the air-water interface and showed good performance reducing the surface tension of water down to values below 40mN.m^{-1}. Preliminary emulsification tests on a model system based on dodecane or toluene as oil will also be presented. These emulsions were characterized by optical microscopy. Oil-in-water emulsions were formed regardless of the ratio oil/water. The stability will also be discussed.

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