Evonik AEROSIL® Dispersions for Chemically Enhanced Oil Recovery

The pursuit of additives to enhance the extraction capacity of fracking fluid has in recent years turned to the use of nano-particles.[1.] Extensive academic and industrial research shows that nanometer and submicron dimension particles, if appropriately designed and surface modified, can play a significant role in Chemically Enhanced Oil Recovery.[2,3.] Nano-particles have the ability to promote the flux of hydrocarbon even from the smallest of pores in oil shale by altering the wettability of the rock surface while also shifting the water/oil mobility ratio (that is, the ability of water to overcome the capillary forces holding hydrocarbon inside geological pores). Some in the industry are offering this technology based on modified colloidal silica particles and claim that simple, unstructured particles can enhance well recovery, in some field trials, by as much as 40%. However, one concern about this technology centers on the question of whether such particles might lead to long-term formation damage – i.e. can these ultrafine particles, while initially making hydrocarbon-bearing pores accessible, in time lead to pore plugging and thereby the rapid shut down of well production. We believe that by designing a better particle, one based on the nano-structuring only possible through the AEROSIL® technology, the result can be particles small enough for pore access, but also characterized by an open pore structure that inherently avoids pore plugging (*figure 1.*).

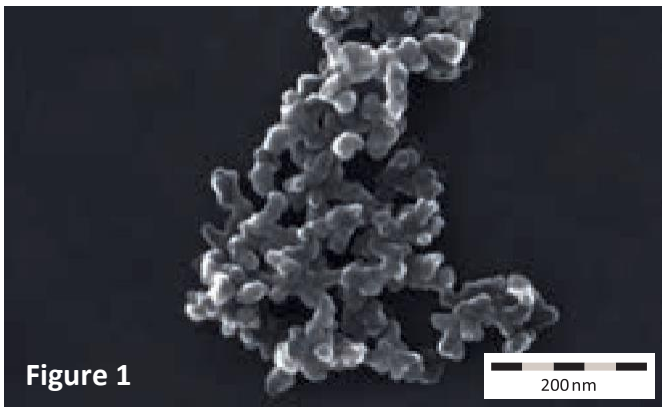

Figure 1

AEROSIL® is a nano-structured silica that provides a perfect platform for further surface chemistry: chemistry that makes the particles stable in water environments, especially those with high mineral salt content; and, chemistry that adjusts for the proper water/oil ratio to maximize hydrocarbon extraction (figure 2).[4,5.] The AEROSIL®-based particles are submicron-sized and have open-pore structure, meaning that there is an unimpeded nano-sized path through the particle. This open-porosity is critical to maintain fluid conductivity and avoid formation damage. Even if the particles accumulate, permeability is maintained, in stark contrast to colloidal silica based technology that has the tendency to cluster and plug the hydrocarbon-bearing pore.

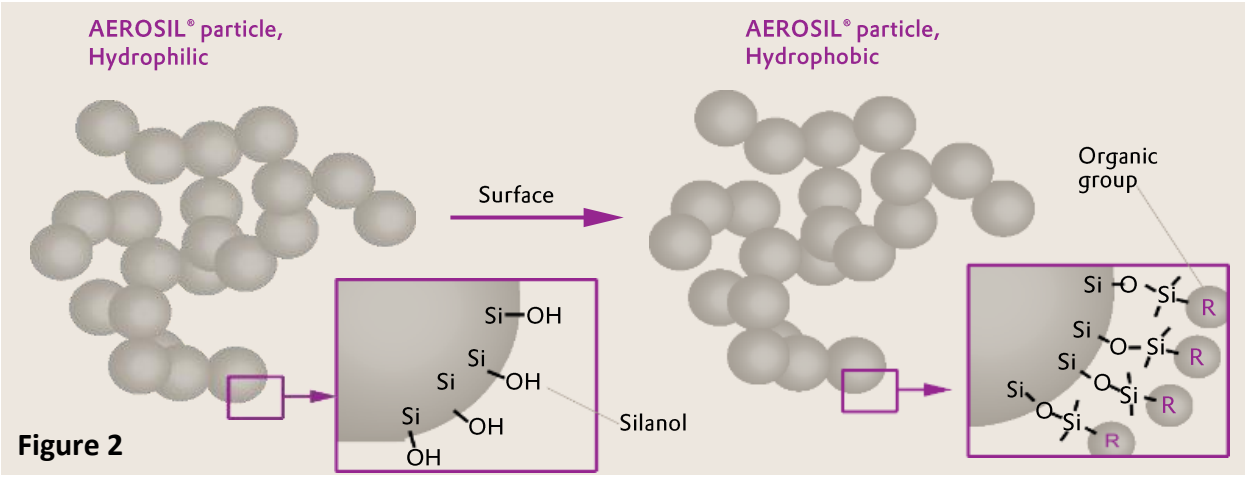

Figure 2

Evonik Silica has a long history of success in developing application specific dispersions based on AEROSIL®, but in this case, we have collaborated with a leading research university in order to learn from their high level of application expertise, precisely tuned to the Oil & Gas Industry. This cooperation has proven very successful in rapidly developing promising frack fluid additive candidates that can be tested in the manner and degree expected by researchers in the field. At present, we are working to expand this strategy of joint development to include commercial partners, those that have the capability of field-testing, to further refine and implement this promising technology.

References:

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