

ELEMENTIS

A global specialty chemicals company

Application Leaflet

BENTONE[®] Organoclays

Surfactant effect on organoclay gel strength



Introduction

BENTONE[®] organoclay materials are based on either Bentonite or Hectorite, both minerals are belonging to the smectite group. In their natural form both minerals are expandable in water due to their microfine platelet stacks based mineralogical structure. As visualized in *Figure 1*, the Hectorite platelets are significantly smaller than those of Bentonite, the resulting edge length per gram of silicate in the Hectorite is much larger. This makes Hectorite additives able to build up a much denser and more rheologically effective network.

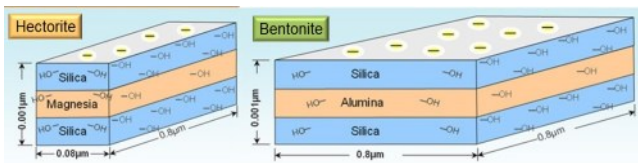


Figure 1: Hectorite/Bentonite comparison

To make the clays compatible with non-aqueous media e.g. solvents or oils, it is necessary to modify the surface of their silicate plates with quaternary ammonium compounds.

In order to be activated, organoclays must be exposed to high shear forces over a defined swelling period. During the activation process, the platelet stack is first subjected to swell in the proposed oil and then smashed with strong shear (*Figure 2*).

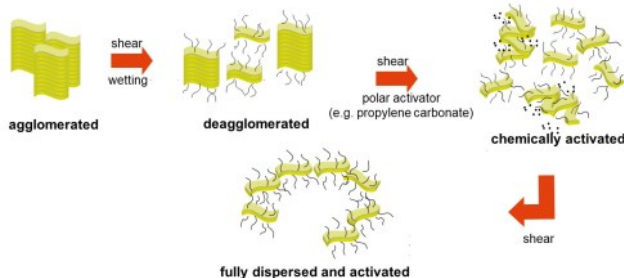


Figure 2: Mechanism of activation

As it can be seen in *Figure 3*, the delaminated, organically modified silicate platelets that result can then effectively rheologically via intermolecular forces, e.g. hydrogen bonds with the water molecules of a polar activator.

In case of the conventional organoclay, except SD grades, the use of polar/chemical activator, such as propylene carbonate, is needed.

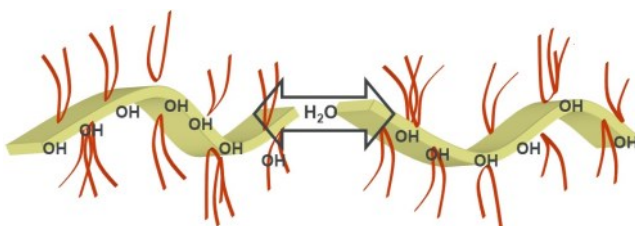


Figure 3: Hydrogen bonding

However, certain product classes can have an influence on the gel strength. These are especially the in following listed substances.

- ◆ Sulphonates
- ◆ Naphthenates
- ◆ Phosphates
- ◆ Dithiophosphates
- ◆ Fatty acid groups in alkyds
- ◆ Succinates
- ◆ Imidazole derivatives
- ◆ Soaps

The degelling effect can be explained by preferential attraction of the hydroxyl groups surrounding the edges of the organoclay platelets to the mentioned materials which reduces the hydrogen bonding strength (*Figure 4*)

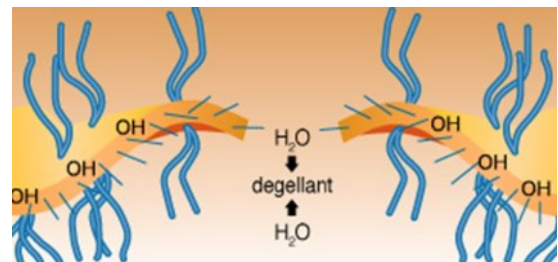


Figure 4: Effect of degellation

The degelling effect of purely inorganic or organic salts is on the other hand only very little.

To avoid issues it should be ensured that wetting and dispersing agents are not being used in excessive concentrations. Proprietary levels of dispersants are only 1/3 of the weight of the organoclay loading. Too high levels of deflocculating surfactants may lead to losses in viscosity and connected properties like sag and sedimentation control, especially when the system ages.

Proper order of addition, especially when using surfactants with organoclays, is necessary. It is recommended to begin with solvent or solvent with resin as the initial charge in the dispersing vessel. The organoclay should then be added under stirring with moderate shear. In case of conventional BENTONE[®] organoclays a polar activator is required which should be added next. This step is not necessary with the use of BENTONE[®] SD grades. The addition of surfactants should be done after the organoclay and the chemical activator have been added to the system.

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