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Borate and Boron Product Usage in the Oil and Gas Industry

Borate mineral ores such as Ulexite and Colemanite, as well as refined borates and boron products, are important additives found in many formulations used in petroleum, natural gas and shale gas well operations in order to maximize yields and improve performance.

When using guar gums, for example, the crosslinking action of borate's $\text{B}_2\text{O}_3$ content gives drilling fluids the viscosity needed at less expense than simply using more guar gum to achieve the same viscosity. Ulexite's delayed solubility means viscosity increase is delayed. When mixed just before using, it is easier to pump drilling fluids at a well head's entry. Furthermore, borate's pH sensitivity means drillers can easily reverse the crosslinking via buffers, making the fluid much easier to pump back to the surface once the job is done. Eti Maden and Etimine USA offer borate and boron product grades designed for oil and gas industry applications, including especially fine particle sizes that reduce filter clogging.

Depending on the situation and type of application—such as drilling muds, well stimulation or fracking—borate and boron products are selected alongside other chemical components in order to modify a formulation's viscosity, pH, thermal stability, lubricity and/or flow rate. Among the more popular borate products for use in oil and gas exploration, drilling and well completion, mineral ores Colemanite and Ulexite are the subject of numerous patents in the energy industry. Formulators and users are strongly encouraged to evaluate the current and pending patents to assess their ability to operate without infringing on protected intellectual property.

Ulexite's slow rate of solubility is a key factor in its selection as a crosslinking agent when used in fluid or mud formulations based on guar gum. Such formulations require property tradeoffs between viscosity and flow rate, which requires energy or pressure to move the formulation appropriately. Fluids must be thin enough to be easily pumped by equipment at the ground surface. Ulexite's sparing solubility delays its crosslinking action until the fluid has navigated the challenging turn. By the time the target deposit is reached, the crosslinking promoted by Ulexite's $\text{B}_2\text{O}_3$ component contributes to the viscosity needed to be effective. Ulexite's crosslinking can be conveniently reversed by lowering the pH. Less crosslinking means lower viscosity, so the formulation can more easily make the return trip to the surface.
Hydraulic fracturing (fracking) is a newer and fast-growing practice for harvesting natural gas from shale formations. Shale gas deposits are approached first vertically to reach the targeted depth, and then horizontally to reach the gas deposit. Delaying the viscosity increase helps to manage the flow through the challenging transition from a vertical to a horizontal plane. Meanwhile, a fracking formulation’s high viscosity enables carrying more proppant to keep an induced fracture open.

Crosslinking with Ulexite has more cost-performance benefits than raising viscosity by simply adding more guar gum, which can be relatively expensive in comparison. Colemanite crosslinks similarly in these applications, although it is even slower to dissolve and crosslink the guar gum. This may be helpful in particular situations. Other borate and boron products used to crosslink guar gum-based formulations include boric acid, Etibor 48 (5 mol borax), borax decahydrate (10 mol borax) or Etidot 67 (disodium octaborate tetrahydrate, or ‘DOT’). Formulations based on gels other than guar gum may use boric acid or Etibor 48 for crosslinking.

Mixing formulations at the drilling site is one way to prevent premature crosslinking. Mixing tanks are fitted with a filter to capture unwanted particulates. Eti Maden and Etimine USA offer a special grade of Ulexite that meets an extremely small particle size specification. This helps it to go into solution, thereby reducing its potential to clog a tank’s discharge filter. This is important to keep operations running smoothly at the drilling site.

The numerous benefits of borate minerals and boron products continue to help oil and gas companies reduce operating costs, improve oils and gas yields and conduct on-site drilling and exploration with enhanced effectiveness and efficiency. Contact Etimine USA to learn more.