Basic Facts About Colloidal Silica Densifier

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Silica is one of the two main ingredients in portland cement. Siliceous clay is mixed with limestone (calcium carbonate) under high heat to make cement. The carbon is driven off by the heat, so the two main ingredients that remain are hard substances, calcium and silicon.

When water is added to cement powder, it reacts and forms compounds called calcium silicate hydrates (CSH).
As a byproduct, it also forms hydrated lime, calcium hydroxide not to be confused with **free lime.**
Hydrated lime can constitute up to 25 % of hardened cement paste **but adds no strength to the concrete.**

How densifiers densify
All Densifiers weather **silicate/siliconate/lithium** require this **useless Calcium Hydroxide** to trigger a reaction. Since calcium hydroxide is intermingled in the hardened cement paste, the reaction creates additional paste inside the pores of the existing paste. Lythic Colloidal Silica does react with the Calcium Hydroxide but also reacts with the Silica content which ensures a consistant and efficient complete reaction and does not rely upon the calcium hydroxide to react.

The paste gets denser, which makes it harder. It is sometimes claimed that densifiers make new CSH crystals. **This is inaccurate**. Cement paste is not a crystal to begin with. Crystals are molecules stacked together in a regular, repeated pattern. In contrast, CSH is technically a gel. The molecules are packed together and hard (not squishy like the gel in the toothpaste tube), but they do not form a regular, repeated pattern.

Differences in silica
The goal of all concrete densifiers is to deliver a reactive form of silica down into the microscopic pore system of the cement paste. They all use a liquid to carry the silica.
The differences are in the form of silica and how the silica is made to stay in the liquid. Colloidal silica delivers virtually pure silica in nanoparticles small enough to penetrate the pore structure.
The liquid has very low surface tension and carries particles below the surface. The pure silica particles have a relatively higher proportion of reactive sites than silicates, so they react very efficiently. In the pores, colloidal silica creates new CSH that bonds to the existing CSH.
Colloidal silica also bonds directly to other silica, including itself. When applied to concrete, it reacts, bonds and then uses that bonded silica as a platform for additional bonding.
Silicate densifiers do not do this. Silicate densifiers are compounds of silicon and a high proportion of mineral salts. (Sodium silicate molecules, for example, are 38 percent sodium by weight and only 62 percent silica. Commercial sodium silicate has even lower silica content due to contaminants.) They are also colloids, but the particle size is highly variable.