

SILICATES, SILICONATES AND FLUROSILICATES EXPLAINED

Reactive sealers for concrete floors are available in many compositions. Although these products share a common end result – a more durable surface – their chemical mechanisms and intended uses can be quite different.

As concrete hardens, water reacts with cement to form calcium hydroxide (CaOH₂) and calcium silicate hydrate (CSH), the main strength producing component in concrete. Because it is relatively permeable, of low strength, and is susceptible to carbonation, the presence of excess CaOH₂ in concrete is undesirable.

There are several different types of liquid densifiers available today. Silicate-based products improve a concrete surface by introducing additional silica that reacts with the excess calcium hydroxide to form more CSH. This results in denser, harder concrete surfaces. Because the concrete is dry when the silicate is applied, this additional CSH formation takes place primarily in concrete surface capillaries. Filling these capillaries with CSH provides an additional degree of impermeability and density to the surface, but the concrete retains its ability to “breathe”, allowing water vapor to freely exit the slab surface. This is the silicate reaction:



Some products offer a blend of sodium silicate and siliconate. The silicate reacts with the concrete as described above, but the siliconate reacts a bit differently. Siliconate applied to concrete undergoes a two part process in which it first reacts with carbon dioxide in the air to form an active silicone resin. The silicone resin then reacts with calcium hydroxide to form a liquid repellent siloxane resin on the concrete surface and within available capillary pores. Siliconates therefore are sealers, not densifiers, and are best used when blended with silicates, which provides both densifying and sealing to a concrete surface. The siliconate seal is microscopic – there is no film build-up on the surface that can wear off over time. These are two primary reactions that take place when applied to concrete:



Another type of silicate-based liquid densifier is a fluorosilicate solution (also called silicofluoride). It, too, reacts with excess calcium hydroxide in the concrete surface to form CSH. However, fluorosilicates also react with calcium carbonate, CaCO₃, which is not abundantly present in good quality concrete surfaces but is a major constituent of inadequately cured, carbonated, or dusting slabs. Fluorosilicate replaces calcium carbonate with silicofluoric gel, a hard and dense material. Fluorosilicates are mainly remedial products, used to improve the durability of dusting floors as recommended in ACI 302.1R, Guide for Concrete Floor and Slab Construction. Therefore, much of the potential benefit is wasted when applied to good quality concrete. The mechanism of fluorosilicate reaction on concrete is shown below.



In conclusion, both silicate and fluorosilicate based liquid densifiers play an important role in improving the surface durability of concrete. Since new slabs are never designed to be soft or dusting, specifying a fluorosilicate for a new construction project is impractical, unless a carbonated surface is expected. Euclid Chemical recommends a silicate/siliconate blend like Diamond Hard as the best material to densify, dustproof, and seal new concrete floors.

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