ALKALI SILICATE-BASED ADMIXTURES FOR CONCRETE FLOOR SLABS

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Where does the need for concrete moisture mitigation originate? Over the past several decades, the number of moisture-related failures of flooring over concrete slabs has increased due to changes in the flooring industry and government regulations of both adhesives and flooring materials. In response, numerous concrete moisture mitigation systems have been developed to reduce moisture vapor emissions and flooring failures. These systems can take the form of concrete admixtures, topical coatings, sheet membranes, or penetrating surface treatments.

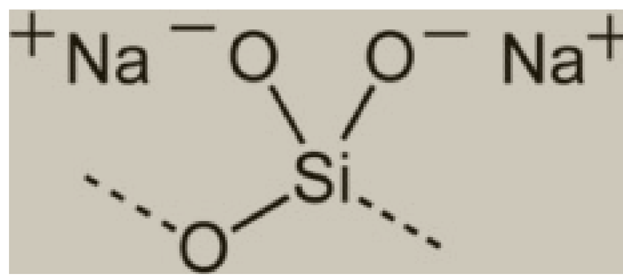
Why consider alkali silicate-based admixtures for concrete moisture mitigation? Of the variety of moisture mitigation products available, silicate admixtures are currently receiving industry attention because of claims they can reduce moisture migration from the slab at a low incremental cost and without interrupting construction schedules. Some manufacturers state that slabs treated with silicate-based admixtures do not require additional concrete surface preparation or product applications before the finish flooring is installed.

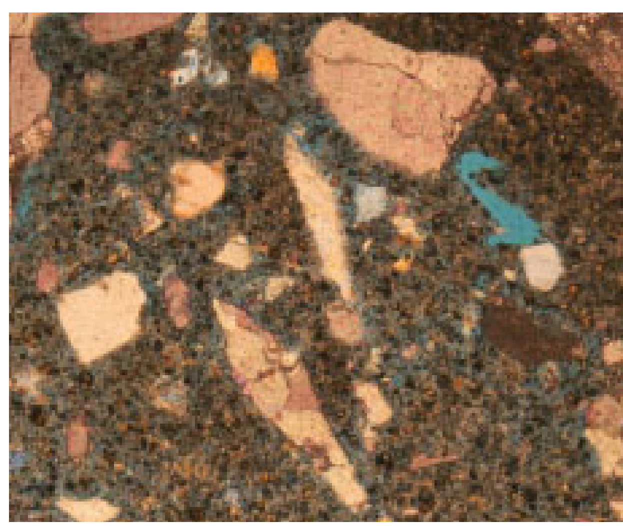
When were alkali silicate-based concrete admixtures first considered? The industry has been experimenting with silicate admixtures for over a century for various reasons, including concrete set acceleration, surface hardening, and dust control. Recently, silicate-based concrete admixtures have been used as curing compounds and for moisture control in concrete floor slabs.

How are alkali silicate-based concrete admixtures intended to function? Reports on the function of silicate admixtures have stated that the added silicates react with calcium hydroxide in the concrete solution chemistry to form calcium silicate hydrate. The calcium silicate hydrate reportedly blocks concrete pore space, which in turn reduces permeability of hardened concrete.

What are some potential concerns of using alkali silicate-based concrete admixtures? Short- and long-term concerns associated with the use of alkali silicate-based admixtures include the following:

- Early research (circa 1910) found that silicate admixtures acted as a set accelerator but reduced strength, generated an increase in efflorescence, and provided no substantial waterproofing benefit. Since then, multiple studies have shown that silicate-treated concrete is permeable and emits moisture as rapidly as untreated concrete. [1]
- Although silicate admixtures have been investigated for over a century, their use in flooring applications is limited, and their long-term performance and compatibility with floor finishes has not been established.
- Concrete treated with soluble silicates will have a reduced free lime content and therefore, will develop less carbonation at the surface than typical concrete, resulting in a higher pH concrete surface.





IMAGES: Moisture-related delamination of resinous floor coating (top); Molecular formula of alkali silicate (middle); Pores and bleed water channels in concrete (bottom)

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- Concrete treated with silicate-based admixtures will respond to typical moisture measurement techniques (i.e., ASTM F1869 and ASTM F2170) in the same manner as concrete without silicate treatments. We have found that the drying rate of concrete treated with alkali silicate admixtures is similar to that of concrete without the silicate admixtures. Applying flooring finishes on concrete without conducting standard moisture testing, as required by flooring manufacturers, will usually void any finish floor manufacturer's warranty.
- Increasing the amount of alkali silicates in concrete will raise the amount of soluble alkali in the concrete and may increase the potential for alkali-silica reactivity (ASR) in concrete containing reactive aggregates.
- The soluble alkali hydroxide created by the addition of alkali silicates may diffuse to the concrete surface, which may in turn increase the surface pH, contribute to efflorescence on the concrete surface, and potentially result in breakdown of the flooring adhesive, failure of the bond, and the formation of surface blisters in conjunction with high moisture loads in the concrete.
- The presence of additional soluble silicates in the concrete may contribute to a denser concrete and result in a reduction in adhesive bond since the applied adhesives may not adequately penetrate the concrete surface.

[1] Citations available upon request.

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