



Jim Caruth
 P.Eng.
 Technical Services
 Manager

ACI International Report Examines Waterproofing Admixtures for Concrete: Crystalline vs. Pore Blocking and Other Admixtures

Of interest to specifying engineers and architects is the new ACI 212.3R-10 Report on Chemical Admixtures for Concrete. This recently published guide has a substantially improved chapter on waterproofing admixtures, titled Permeability Reducing Admixtures or PRAs.

This report examines three classes of admixtures that all reduce, in some way, the permeability of concrete. The classes are hydrophobic or water-repellent chemicals, mineral fillers, and crystalline materials. In addition, the report defines two sub-categories for admixtures intended to reduce water ingress as either a PRAN – for concrete not subject to hydrostatic pressure, or as a PRAH – for concrete that is subject to hydrostatic pressure.

The water repellent or hydrophobic admixtures are based mostly on fatty acid derivatives called stearates which interact with calcium hydroxide in the pore water to form an insoluble stearate that lines the pore walls. Waxes and oily emulsions can also be used as a base for hydrophobic admixtures but they are non-reactive. These types of admixtures are effective in reducing the absorption and ingress of chlorides into concrete but usually only under non-hydrostatic conditions and thus are usually classified by this document as PRANs.

The mineral fillers are inert finely ground minerals such as talcs, bentonites, clays etc but can also include chemically active materials such as lime and alkaline silicate based products. Some experts include SCMs in this category as well. While these materials will often densify the matrix and possibly shrink the pores of the concrete and restrict water passage, they typically do not fully block all pores and as such are also classified as PRANs.

Crystalline-based admixtures, on the other hand, are hydrophilic in nature and react with the constituents of the cement matrix to form CSH crystals. These crystals generate pore blocking deposits that are found to improve the concrete's ability to resist water penetration under pressure. These admixtures have been found to remain chemically active within the concrete and will seal additional gaps up to a certain size as they occur.

The ACI 212.3R document recommends PRAH type admixtures for applications that will experience hydrostatic head such as below grade and water retaining structures. The ACI 212.3R document further recommends that the water pressure resisting capabilities of the admixture modified concrete should be checked and confirmed through the use of permeability tests such as the US Corp of Engineers C48, DIN 1048 or BS EN 12390. The results of these tests can be used to determine a permeability coefficient K, or side by side testing against a control can be used to give an indication of permeability reduction.

TechNote

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Xypex Admix products would be classified as PRAH and have excellent crack healing properties. As such, Xypex admixtures are ideally suited for concrete that will need to perform in the most severe waterproofing applications. Furthermore, Xypex-treated concrete improves many of the other engineering properties of concrete such as its freeze and thaw resistance, corrosion resistance, chemical resistance and carbonation resistance.

Many of Xypex's competitors have for years suggested that their active or inert pore blocking technology will give performance similar to Xypex, but this recently released document from ACI suggests otherwise. The latest copy of the ACI 212-3R-10 is available on-line from ACI International and is suggested reading for those in the concrete industry.

Xypex introduced Xypex Crystalline Technology some 40 years ago and has become a primary resource to the concrete industry for information regarding crystalline waterproofing.