Determination of the Long Term Performance of ATPG Coating on Concrete

The American Concrete Institute has determined that there are three primary strengths that are very important for most civil and mechanical engineering evaluations of coatings over concrete. They are; compressive strength, tensile strength, and bond strength. The ability to balance these various strengths is critical to the long term performance of any coating over concrete substrates.

Compressive Strength

Compressive strength is the ability of the material to handle weight. Compressive strength tests are run by pushing both sides of a cylinder of the coating (or concrete etc.) on the top and bottom of the cylinder. Typical numbers most non-flexible epoxies start at slightly under 10,000 psi (pounds per square inch) and work their way up from that. To put this into perspective typically quality concrete has a compressive strength of about 3,000 psi. Very high end concrete can have compressive strength of about 5,000 psi but concrete at that very high strength is not typical. Most concrete is 3,000 psi plus or minus.

Some people think that the higher the tensile strength the “better" the material. That is not necessarily true. As some epoxies get to very high compressive strength they may become brittle. If a product is brittle it can still break easily. That is because flexural strength has been compromised for the sake of getting a higher compressive strength number.

ATPG Industrial Coating is formulated to balance all the various strengths needed for a specific application. For example, when installing ATPG IC over concrete, there is no need for IC to have a compressive strength of more than a couple times more than the concrete. That gives a high safety margin so that if there is a high compressive load the concrete will fail before the epoxy. Once the concrete has failed the ATPG IC is just along for the ride.

Interestingly enough in the real world materials don't really fail in compressive, they typically break on the side opposite the side of the load first, which means it actually fails in tension.

Tensile Strength of ATPG

The Tensile of ATPG is basically the load in just the opposite direction of compressive strength. Tensile strength is tested by pulling on the top of the coating.

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Materials do not break in compression, they break in tension. As an example, take a tooth pick or some material that you can bend in your hands until it breaks. It does not break on the side you are pushing on (the compressive side) first. It brakes on the side you are pushing towards first. The side that is in tension is the side you are pushing to. That makes the tensile strength the most important one to consider when comparing materials.

In the case of concrete the tensile strength normally tests out at about 10% of the compressive strength. So concrete with 3,000 lb. compressive strength typically only has about 300 lbs. of tensile strength. By comparison ATPG IC has a much higher tensile strength verses compressive strength. ATPG IC has a measured Tensile Strength of 2800 psi. So since materials break in tension first ATPG IC is 10 times higher in tensile strength than standard concrete.

Bond Strength

Bond strength is the measurement of how well a coating bonds to the substrate. ATPG IC is designed to have a bond strength on concrete that is greater than the tensile strength of the concrete. If the bond strength of a coating material is greater than the tensile strength of concrete than if there is a failure it will be a failure of the limits of the strength of the concrete not the coating.

It is a widely held belief that high elongation is necessary for a coating to successfully protect concrete and other substrates. It is noted by the ASTM Paint Testing Committee that elongation, which is the ability of a free form film to return to nearly its original length has no correlation to in-service performance. The key performance characteristics needed are adhesion to the substrate and resistance to the environmental conditions present in the geographic region where the coating is intended to be placed in service

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