EXTENDING THE LIFECYCLE OF STORM WATER CULVERTS UTILIZING ORGANIC / INORGANIC MATERIALS

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GEOPOLYMERS AND CBPCs

Barton Industries is involved in the study, design, and development of materials used in the protection and rehabilitation of various infrastructure components including storm water culverts. These materials can be utilized with concrete, steel and wood substrates. Applications include stopping water infiltration and exfiltration, void filling, providing structural support, as well as corrosion and abrasion (scour) protection using a combination of polyurethane and geopolymer based materials. Across the United States and Canada there are tens of thousands corrugated metal culverts in dire need of repair that cannot easily be dug up and replaced thus the need for trenchless rehabilitation methods to solve several issues. Effective, cost conscious, alternative methods to "dig and replace" are needed for municipalities to address these looming issues. Some of the same issues are also found in precast and cast-in-place structures as well. This technology can also be utilized in protection of manholes, utility vaults, lift stations, pipelines, tanks, tunnels, seawalls....etc.

First industrial research efforts about geopolymers were done in 1972 at the Cordi-Geopolymere private research laboratory, Saint-Quentin, France (Davidovits, 2006). Geopolymers serve as an elite class of construction materials that can be used as a binder, a type of cement for concrete or as grouts. Extensive research is currently being conducted to get superior working properties on geopolymers that can be subject to varied forms of delivery systems as the target application requires. Generally, geopolymers are categorized as materials formed by the geosynthesis of a reaction between an aluminosilicates and alkaline solution (Davidovits, 1982, Provis, J.L. and Van Deventer. J.S.J., 2009). Geopolymers are not to be confused with the broad category of alkali activated cements as the slags activated by alkaline solutions result in a calcium silicate-hydrate based one dimensional gel but the alkali activated geopolymeric system produces a geopolymeric gel which is three dimensional alkali aluminosilicate gel. However, it is to be noted that, in a generic sense, the alkali activated cements are mostly silicate based compounds.

While geopolymers which are primarily alkaline in nature were discovered in the early 1970s, extensive research was also simultaneously conducted to react the acidic and basic components to form a new class of hard cementitious salt like three dimensional

structures. These products have been in prevalence since the mid19th century (Wilson and Nicholson, 1993). The basic side often corresponds to the oxides or hydroxides of di or trivalent metals. These have been generalized as the Acid-Base (AB) cements, a class within chemically bonded products (Wagh, 2013). Chemically bonded phosphate ceramics (CBPCs) was extensively studied by Wagh and his coworkers for over the past decade which mainly discussed the formation of ceramics by reacting phosphoric acid or an acid phosphate with several other basic di- or tri-valent oxides.

We, at Barton Industries, extend the innovative concepts of geopolymers and CBPCs to study and develop binders and coatings that can be used for various applications such as thermal insulation, substrate corrosion protection … etc. It is still an active ongoing investigation that focusses to study the long and short term performance of inorganic ceramic coatings and the geopolymers for their strength, physical, chemical and working properties.