Tech Tips 030

Galvanic Corrosion of Metallic Waterstops in Concrete

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The effects of galvanic corrosion on reinforcing steel.

Galvanic reaction in concrete with metallic waterstops is crucial in construction and civil engineering. Metallic waterstops are commonly used to create a barrier against water infiltration in concrete structures. However, when these metallic waterstops come into contact with the concrete, they can lead to galvanic reactions.

When two different metals come into contact with each other in concrete, they can undergo a galvanic reaction, also known as bimetallic corrosion. This change occurs when one metal, known

as the anode, corrodes faster than the other metal, known as the cathode, due to differences in their electrode potentials.

This phenomenon is particularly relevant in concrete as it is often used as a structural material and may contain metals such as steel reinforcing bars or metal fixtures (metallic waterstops). When these metals come into contact, they can form a galvanic cell, with the more reactive metal experiencing accelerated corrosion, ultimately leading to the concrete structure's degradation and compromising its integrity.

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The severity of the galvanic reaction depends on several factors, including the types of metals involved, the conductivity of the concrete, and the presence of moisture. For example, when steel and aluminum come into contact in concrete, the aluminum acts as the anode and corrodes faster than the steel, leading to the production of aluminum oxide, which can expand and cause cracking in the concrete.

The most common combinations of metals in contact with concrete that are prone to galvanic corrosion are:

1. Steel and aluminum
2. Copper and steel
3. Zinc and steel

The following actions can help mitigate galvanic corrosion in metal and concrete applications:

1. Protective coatings: Applying protective coatings or paints to the metal surfaces can help insulate them from direct contact with the concrete, reducing the risk of galvanic corrosion.

2. Use of insulation: Using insulating materials, such as non-conductive washers or gaskets, between the metal and concrete can interrupt the electrical connection and prevent galvanic corrosion.

3. Selecting compatible metals: When choosing metals for use in concrete, it is important to select metals less prone to galvanic

corrosion when in contact with each other. For example, using stainless or galvanized steel can be less prone to galvanic corrosion than bare steel.

4. Cathodic protection: Utilizing sacrificial anodes or impressed current systems can provide cathodic protection to the metal, preventing galvanic corrosion from occurring.

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In conclusion, the galvanic reaction in concrete with metallic waterstops is a crucial concern in construction. Understanding the principles of galvanic corrosion and taking appropriate measures in material selection and concrete mix design can minimize the risk of corrosion and potential structural issues.