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Coatings and Cathodic Disbondment – the story revisited

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Abstract

Metallic pipes for buried and immersed services are commonly foreseen with coatings that intend to create an effective barrier for substances that would otherwise cause corrosion. Coating degradation and damage to pipe coating is almost unavoidable, and this may expose the pipe to possible corrosion. Cathodic protection is often installed to act as a back-up for coating imperfections but this has electrical, chemical and physical interactions with the coating.

The electrical resistance of a coating is an important parameter for the design of Cathodic Protection system, and e.g. ISO15589-1:2015 contains information about CP for typical coatings. The coating resistance of alternate coatings can be determined by using the method as described in ISO 21809-3 “Specific Electrical Insulation Resistance”, but this method does not account for coating degradation over time.

Damage to a coating up to bare steel will be protected by CP through electrochemical processes, which may also lead to disbondment of the coating. The bare metal area is then protected by activation polarization, while the disbonded area is protected by high pH of the electrolyte in case of convection blocking.

Many different methods exist for testing cathodic disbondment of coatings, but results obtained by various available methods cannot be readily compared since test setup and conditions vary greatly. Furthermore, cathodic disbondment tests are always done on newly applied coatings and are only tested for a short period of time, e.g. 30 days. Lifetime expectancy of pipelines however are much longer, typically 30 years or more. During its operating lifetime a coating will age and essential properties such as adhesive strength will deteriorate. This can be simulated by Hot Water Immersion testing followed by peel-testing. Results obtained with cathodic disbondment testing do not make much sense if over time the coating spontaneously disbonds due to ageing processes.

Non-crystalline low-viscosity polyolefin coatings based on pure homopolymer Polyisobutene do not show cathodic disbondment when tested according to ISO21809-3, due to the unique self-healing effect of small defects. Furthermore it has been proven that they are not susceptible to ageing. Results of peel test and self-healing after Hot Water Immersion tests and Thermal ageing tests both for 100 days at Tmax +20°C were similar to values obtained with non-aged test specimens.