A discussion of stress corrosion cracking of pipelines based on today's understanding of the processes involved in cathodic protection

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Abstract

Stress corrosion cracking (SCC) of pipelines has the potential of severe damage. While corrosion due to AC and DC interference or insufficient levels of CP usually results in a leaks, SCC can cause rupture of the pipelines. This implies severe safety risks including casualties. Such events have indeed been observed in the past. The majority of the reported incidents occurred in North America, Australia and Russia. Interestingly there are very limited cases of SCC in Europe. In absence of reported cracks or damages limited attention has been payed to SCC in Europe. This changed with the observation of cracking of up to 50% of pipe wall thickness on a pipeline in Germany, as reported in UKOPA/GP/009. In the context of these damages it is relevant to readdress the concepts and the experience in association with SCC. There have been extensive investigations with respect to cracking in the last century. These investigations were primarily based on fracture mechanical concepts. The development of a complete and comprehensive understanding of the processes involved in cathodic protection (CP) in recent years allows today for a different view on these data. This paper presents a discussion of the different types of SCC in the light of today's understanding of the relevant mechanisms. It further highlights the possible contribution of hydrogen to SCC and draws some preliminary conclusions with respect to the implications on the operation of CP.