

Effect of Steel Metallurgy on Pipeline Corrosion Studied by Micro-electrochemical Techniques

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Both field experiences and lab testing demonstrate that pitting corrosion can be initiated on pipelines that are under cathodic protection (CP). It was proposed that a local electric field conversion occurs at metallurgical defects, such as non-metallic inclusions, present on the steel surface, resulting in occurrence of local anodic dissolution even though, macroscopically, the steel is under cathodic polarization. Furthermore, preferential corrosion occurs frequently at pipeline welds and the adjacent regions. Moreover, hydrogen, once entering steels, would accumulate at welds and affect the local corrosion behavior. Therefore, the metallurgical feature of pipeline steels plays a critical role in corrosion of the steel in the service environment. This talk summarizes the author's latest research in this area. In addition to microstructural characterization conducted on varied grades of pipeline steel, micro-electrochemical measurement techniques were used to measure the local corrosion activity at various metallurgical defects at a spatial resolution of 10 microns. Interesting results show the corrosion process at a microscopic scale, and thus at a more mechanistic level.