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Title: Engineering of Corrosion Product Via an Eco-friendly Polymer

Authors: Dilshad Shaikhah, Wassim Taleb, Maalek Mohammed Said, Bruce Cowe and Richard Barker

Abstract

Carbon dioxide internal corrosion of carbon steel pipelines remains a major issue that is typically mitigated via the addition of corrosion inhibitors. In specific operational environments, a protective natural corrosion product layer known as iron carbonate ($FeCO_3$) can evolve on internal pipeline walls, providing comparable corrosion inhibition efficiency to that achieved from surfactants. However, in some instances, incomplete corrosion product coverage can initiate localised corrosion. In our previous work, we demonstrated the ability of Poly (allylamine hydrochloride) (PAH) to act synergistically with $FeCO_3$ when the corrosion product exhibits partial coverage of ×65 carbon steel surfaces in an aqueous CO_2 corrosion environment. In this work, we employ Rotating Cylinder Electrode (RCE) coupled with electrochemical measurements to study the $FeCO_3$-PAH hybrid structure in hydrodynamic environment. The general and localised corrosion behaviour as well as surface properties of a naturally formed $FeCO_3$ and the $FeCO_3$-PAH hybrid layers are characterised employing RCE, interferometry, scanning electron microscopy (SEM) coupled with focused ionic beam (FIB).

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