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Effect of Cathodic Polarization on Corrosion Behavior of X65 Steel in Seawater Containing Iron-oxidizing Bacteria

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Microbiologically influenced corrosion is mainly caused by the biological activity in the biofilm, which clearly illustrates the role of attached bacteria in the form of biofilm in initiating or accelerating corrosion. Although it has been proven that electrochemical methods can prevent the formation of biofilms on metal surfaces, the special effect of cathodic polarization in bacterial attachment and growth is still inconclusive. The purpose of this work was to investigate the effect of cathodic polarization on the attachment of iron-oxidizing bacteria (IOB) in seawater during the initial stage of biofilm formation. Results showed that under the polarization potential of −1050 mV $_{vs.\ SCE}$, IOB attachment and biofilm growth were well controlled. Further, the potential of −1050 mV $_{vs.\ SCE}$ exhibited more effective inhibitory effect on IOB-induced pitting corrosion than that of −700 mV $_{vs.\ SCE}$, which was related to the accumulation of electrons on the metal surface during cathodic polarization. The cathodic potential of −1050 mV $_{vs.\ SCE}$ also altered the electrochemical parameters at the metal-biofilm interface, such as the increase of pH and the formation of protective calcareous deposits, which contributed to protect the metal from IOB-induced corrosion.

Keywords: Microbiologically influenced corrosion; Cathodic polarization; Iron-oxidizing bacteria; Bacterial attachment; Biofilm

FULL TEXT