Effect of dissolved oxygen accelerated marine P. aeruginosa on the corrosion behavior of X70 steel

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Abstract Dissolved oxygen has a very complex effect on microbial corrosion in the ocean. In this paper, the impact of dissolved oxygen on the corrosion behavior of X70 steel in seawater environments with and without P. aeruginosa was investigated by electrochemical testing, surface morphology observation, corrosion weight loss analysis, and elemental analysis of corrosion products. The results showed that the uniform corrosion rate in the anaerobic P. aeruginosa seawater environment was lower than that in the sterile seawater environment, but the local corrosion was severe, with the maximum width of the pitting crater being 578.38 μm, and the maximum depth being 49.95 μm. P. aeruginosa formed a biofilm on the surface of the steel substrate, and the presence of the biofilm promoted local corrosion. The addition of dissolved oxygen accelerated the overall corrosion of X70 steel by marine P. aeruginosa, with a maximum corrosion rate of 45.62 mpy after 7 d of immersion, which was about two orders of magnitude greater than the corrosion rate of P. aeruginosa under anaerobic conditions. The presence of dissolved oxygen accelerated the metabolic activity of P. aeruginosa, promoted the redox reaction of the steel matrix, and produced a large number of metal oxide films and microbial films, which were doped with microbial films to form a composite product film, and the metal oxides mainly consisted of Fe_3O_4, FeOOH, and Fe_2O_3, and the incorporation of dissolved oxygen greatly influenced the overall corrosion of P. aeruginosa on the X70 steel uniform corrosion and also promoted local corrosion to some extent.

Keywords MIC, P. aeruginosa, dissolved oxygen, localized corrosion, uniform corrosion, biofilm

Reference

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