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Crevice corrosion performance of high-alloy stainless steels and Ni-based alloy in desalination industry

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ABSTRACT

Several high alloys are candidate materials for the severe corrosive environment of reverse osmosis desalination plants. In the present study, the crevice corrosion performance of duplex, superduplex, superaustenitic stainless steels, and nickel-based alloy was investigated in natural and chlorinated seawater, at different temperatures. Several crevice configurations were evaluated including flanges assembled with gaskets, bolts mounted with nuts to plates, and the standard CREVCORR-type crevice formers. It was thus possible to illustrate the effect of crevice configuration on the corrosion behavior of the different alloys. The crevice geometry was confirmed to be of major importance in terms of risk for initiating crevice corrosion. In natural seawater (i.e. not chlorinated), the most severe temperature was 30˚C, due to high biological activity and high corrosion kinetics. Chlorination at 0.5 ppm increased the risk of localized corrosion but decreased the corrosion propagation rates. In chlorinated seawater, crevice corrosion risk significantly increased with temperature for all tested alloys. For each of the tested configurations, the superaustenitic stainless steel UNS S31266 showed better crevice corrosion resistance than superaustenitic UNS S31254 and S34565, superduplex S32750, and also nickel-based alloy N06625. The present results are part of a three-year Joint Industry Program supported by end-users, engineering companies, and material producers.

Keywords: Stainless steel; Nickel-based alloy; Crevice corrosion; Seawater; Biofilm; Chlorination; Flange; Bolt and nut; Crevice corrosion

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