

Influence of Different Halide Ions on the Temperature
Dependence of the Resistance of Stainless Steels to
Pitting Corrosion

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The ability of molybdenum to prevent pitting corrosion in stainless steels in chloride environments is well established, but its effectiveness in against other halide ions is less clear cut with some reports even suggesting that the steels microstructure played an important role. To shed light on this issue the pitting behaviours of 304L, 316L, super-austenitic UNS S31254 and super-duplex 329 stainless steels were investigated a wide temperature range from 3°C to 90°C in 1 M solutions of NaCl, NaBr and NaI by potentiodynamic polarization and potentiostatic pitting transient techniques supported by SEM and XPS analysis of the passive films form in these environments.

At elevated temperature all stainless steel grades were more susceptible to pitting in chloride than in the other halide solutions. However, pitting potentials increased exponentially with decreasing temperature in chloride, but only linearly in the other halide environments. This results in grade specific cross over temperatures below which the pitting resistance is lower in bromide than in chloride, which may explain some of the contradictory results in the literature. The pitting transient measurements also revealed similar temperature dependences. Possible pit nucleation mechanism to explain the observed dependence of the pitting resistance - temperature relationship on the nature of the halide ion will be discussed.

For the case of 304L stainless steel the nature of the cation was also found to influence the resistance to pitting in bromide environments, with the pitting potential increasing with decreasing cation size of the cation from K^+ through Na^+ to Li^+ . A mechanism whereby the decrease in the cation mass transport rate with increasing size could increase the rate of acidification in occluded solution with in pit nuclei and thus increase the changes of stable pit growth.

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