

HASTELLOY® C-276 and C-22® alloys

Comparison in Saturated Wet Chlorine

Corrosion tests were performed in a saturated wet chlorine environment to compare the performance of HASTELLOY® C-276 and C-22® alloys as a function of temperature. The environment was 3000 ppm Cl solution adjusted to pH 1.5 with HCl and chlorine gas which bubbled through the solution for the entire test period. The exit gas was bubbled into a beaker of water to maintain a slight back pressure of chlorine gas in the vapor phase. The pH at the end of the 30-day test period was 0.9.

The first test was performed with coupons hung vertically at the liquid/vapor interface. The liquid temperature was 65°C. The C-276 alloy coupon suffered severe weld-metal attack at the vapor-phase end of the coupon (Figure 1). No attack was observed on C-22 alloy by an examination at 40X with a microscope.

The second test was conducted with two coupons totally immersed in the liquid phase at 80°C, and two coupons hung entirely in the vapor phase (65°C). In the liquid phase (80°C) C-276 alloy suffered severe weld-metal corrosion and intergranular attack in the heat-affected zone. There was no attack of C-22 alloy which had a uniform corrosion rate of 1.5mpy (Figure 2a). In the vapor phase (65°C) there was no localized attack of C-22 alloy (2.5 mpy). C-276 alloy suffered slight weld-metal pitting, minor heat-affected-zone attack, and slight base-metal etching (Figure 2b).

A third test was performed on HASTELLOY C-22 alloy coupons in the liquid phase (95°C) and vapor phase (90°C). Since C-276 alloy experienced corrosive attack at lower temperatures, it was omitted from this test. No localized attack was observed on the coupons (Figure 3). The sample exposed to the liquid phase (95°C) had a uniform corrosion rate of 0.9 mpy, and the sample exposed to the vapor phase (90°C) had a corrosion rate of 5 mpy.

Conclusion

HASTELLOY C-276 alloy suffered corrosive attack (most severe in weldments) at 65°C in the vapor phase and at 80°C in the liquid phase. HASTELLOY C-22 alloy did not suffer localized attack at 95°C in the liquid phase or at 90°C in the vapor phase. HASTELLOY C-22 alloy is significantly more resistant to wet chlorine environments than HASTELLOY C-276 alloy.

P. E. Manning

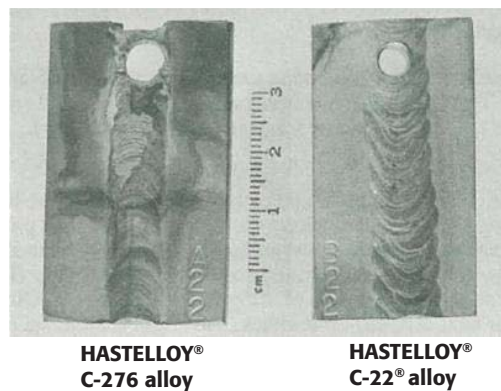


Figure 1: Samples placed at the liquid/vapor interface at 65°C. Note the weld attack at the top of the HASTELLOY® C-276 alloy coupon. (Neg. #44318)

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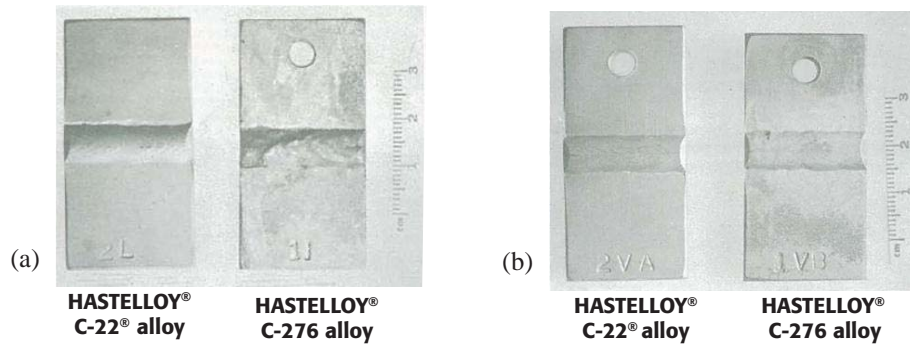


Figure 2: Samples exposed in
(a) The liquid phase at 80°C. (Neg. #46867)
(b) The vapor phase at 65°C. (Neg. #46868)

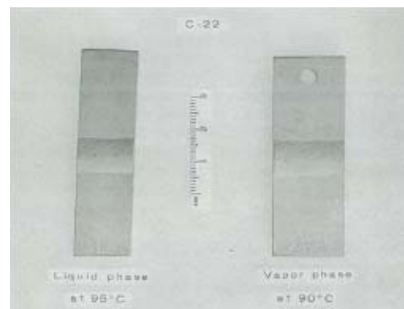


Figure 3: HASTELLOY® C-22® alloy coupons show no localized attack at temperatures nearing the boiling point in saturated wet chlorine with 3000 ppm Cl (Neg. #47018)

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