

# HASTELLOY<sup>®</sup> C-22<sup>®</sup> alloy for HCl in Semiconductor Manufacturing

## Excels in Tests for HCl Transmission Lines

Corrosion failure of HCl transmission tubing in plants manufacturing microchips and semiconductors has been a recurring problem. Corrosion is caused by formation of hydrochloric acid upon reaction of HCl with moisture. The hydrochloric acid eats through stainless tubes in a short time. In an effort to find a better material for HCl lines, laboratory corrosion tests were conducted on both stainless steel and HASTELLOY<sup>®</sup> C-22<sup>®</sup> alloy. A dry/wet HCl test apparatus (Figure 1) was designed to simulate the chemical reactions in the transmission lines at various temperatures. Dry HCl gas (technical grade) at 5 psi is passed over a kettle reactor of heated distilled water. The gas picks up moisture from the condensing of the water to form HCl and then passes through the tube sample. The test temperatures noted are the kettle vapor phase temperatures. The temperatures of the alloy 316 and C-22<sup>®</sup> tubes and the gas flowing through the tubes were lower than the kettle vapor phase but were not measured.

### Accelerated Corrosion Test Results in Dry / Wet HCl

| Corrosion Rate, mils per year  |    |                          |       |
|--------------------------------|----|--------------------------|-------|
| Kettle Vapor Phase Temperature |    | Type 316 Stainless Steel |       |
| °F                             | °C |                          |       |
| 125                            | 52 |                          | 28.8  |
| 150                            | 66 |                          | 51.5  |
| 200                            | 93 |                          | 121.0 |

This accelerated corrosion test, designed to compare alloy performance, shows HASTELLOY<sup>®</sup> C-22<sup>®</sup> alloy has excellent corrosion resistance in dry/wet HCl gases, even at elevated temperature. Since transmission lines are of thin-wall material, corrosion attack must be minimal. Replacement of 304/316 stainless steel transmission lines with HASTELLOY<sup>®</sup> C-22<sup>®</sup> alloy would provide much longer service life. Corrosion data at a kettle vapor phase temperature of 52°C (125°F) show HASTELLOY<sup>®</sup> C-22<sup>®</sup> alloy with corrosion rates over 288 times lower than 316 stainless. This indicated C-22<sup>®</sup> alloy should outlive the life of the plant itself.

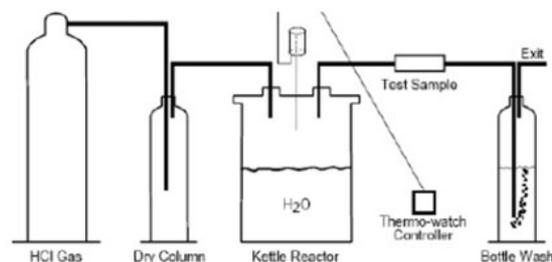


Figure 1:  
Dry / Wet HCl Test Apparatus