Optimizing Cooling for Highly Corrosive Process Fluids

A SilcoTek® Case Study with:

EXERGY
HEAT TRANSFER SOLUTIONS

The Objective:

A customer needed a heat exchanger solution to enhance the cooling process of various acids and bases to counteract the heat generated by process equipment such as pumps and reactors.

The Challenge:

The process involved highly corrosive fluids that were incompatible with 316L stainless steel, creating a material selection hurdle; LiOH (6 M), HCl (3 M), H_2SO_4 (3 M), LiCl (4 M).

The solution was to include four heat exchangers and a chiller within their financial limits. The customer was currently using Hastelloy® components in other parts of the system, however their budget constraints required a more cost-effective alternative as they required four heat exchangers plus a chiller to fit within the project budget.

The Solution:

Exergy's 23 Series shell & tube heat exchanger, Model 05211-01, coated with SilcoTek Dursan® 2500, emerged as the ideal solution due to its compact size, lightweight design, and straightforward installation process. Key features included:

- 1-inch OD shell x 8-inch length with 0.58 sq. ft. heat transfer surface area, weighing only 1.03 lbs.
- Base material: 316L SST, coated with Dursan® 2500 for enhanced corrosion resistance.

The Solution continued:

Innovative Material Solution

To address the range of demands from low pH acids to high pH basic solutions, Exergy collaborated with SilcoTek to coat the stainless steel heat exchanger with Dursan 2500. Key coating benefits include:

- Enhanced high-pH durability combined with moisture and contamination barrier properties, safeguarding the heat exchanger in LiOH environments.
- Corrosion resistance comparable to the performance of Hastelloy® at a fraction of the cost and lead time.
- Improved corrosion resistance by up to 160x in 6M HCl at room temperature, reducing the risk of equipment failure and extending service life.

The Results and Benefits:

Exergy's custom solution successfully met the customer's cooling requirements, while providing a high-performance, economical, corrosion resistant alternative to Hastelloy material. The customer confirmed this with a soak test on both an uncoated 316L SST heat exchanger and SilcoTek Dursan 2500 coated 316L SST heat exchanger. After 7 days the SilcoTek Dursan 2500 coated heat exchanger revealed that unlike the uncoated heat exchanger, the stainless steel alloy components (Fe, Ni, Cr) did not leach into the test solution, confirming the coating performed as intended against the corrosive process chemicals.

This case highlights Exergy's capability to tailor solutions for challenging and corrosive environments, ensuring long-term reliability and customer satisfaction.

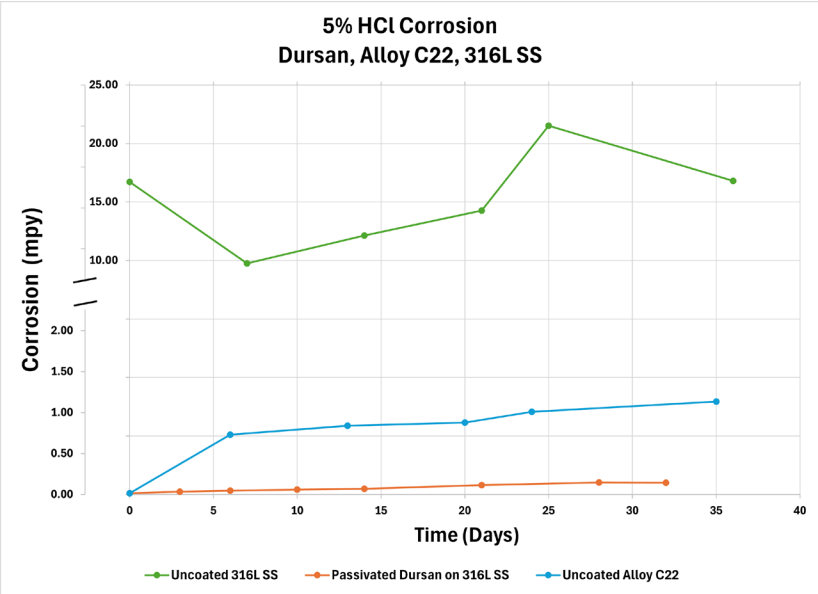

Figure 1. Corrosion rate comparison after 5% HCl soak shows Dursan and Hastelloy outperforming 316L SS, with a slightly improved rate using Dursan.

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