

Improve Moisture Dry-Down and Corrosion Resistance

Restek treated tubing and system components offer improved analytical reliability and longer lifetimes.

Louis, MO). All tubing was tested as 100 foot coils of 3/4" OD x 0.020" wall 316L stainless steel.

Introduction

Gas transfer systems serving the semiconductor industry often require low moisture content and retention, and high resistance to corrosion. The current substrate of choice in semiconductor manufacturing, electropolished VIM/VAR (vacuum induction melt/vacuum arc melt) 316L stainless steel, frequently is insufficient in these capacities, increasing periodic maintenance, prolonging equilibration times, and allowing system contamination and inaccurate analytical results. In contrast, surface treatments available through the Restek Performance Coatings Group provide significant added value to conventional stainless steel substrates, by greatly accelerating wet-up and dry-down times and dramatically improving corrosion resistance.

Electropolished tubing had a surface roughness of 10 to 15 microinches. Siltek® treated tubing (Restek Performance Coatings, Bellefonte, PA) is finished with 5µm of amorphous silicon, followed by a surface functionalization that increases inertness and hydrophobicity.

Wet-up curves for Siltek® treated electropolished, electropolished, and standard tubing are compared in Figure 1. Treated electropolished tubing reached the 98% saturation limit in 30 minutes, compared to 60 minutes for electropolished tubing. Standard tubing could only achieve a 96% uptake, after 180 minutes.

Economical solutions for ultra-high purity streams

Restek surface treatment extends the lifetimes of steel and steel alloy systems, while maintaining high dimensional tolerances, high temperature capability, and leak-free conditions.

- Up to three times faster wet-up or dry-down than electropolished or conventional surfaces.
- Corrosion resistance improved tenfold, or more—increases component lifetime and maintains pure product stream.
- Custom services: can be applied to existing equipment.

for more info

For more information about the anti-corrosive properties of Silcosteel®-CR treatment, request packet 59048, or visit us online.

Restek surface treatments deposit an amorphous silicon based layer onto, and into, the steel surface through a chemical vapor deposition (CVD) process in vacuum at 400°C. There are no line of sight limitations; all exposed surfaces are coated. Layer depth is well controlled and, for corrosion resistance, is optimized at 5 to 10 microns. The amorphous silicon layer can be further functionalized using the patented Siltek® process (US Patent #6,444,326), which has been optimized to reduce moisture hold-up and improve surface inertness.

Data for wet-up and dry-down experiments, measuring the relative response time for moisture content change in treated electropolished stainless steel tubing, untreated electropolished stainless steel tubing, and standard 316L stainless steel tubing, demonstrate a significant advantage in treated versus untreated substrates.¹ Tubing used in the wet-up / dry-down experiments was supplied by Cardinal UHP (St.

Figure 1 Restek treated electropolished tubing stabilizes at 1ppm moisture much faster than conventional surfaces.¹

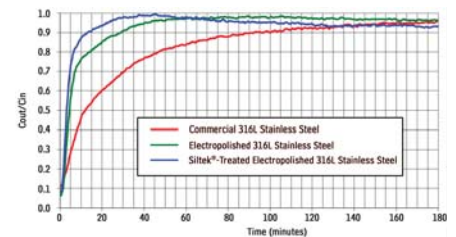


Figure 2 Restek treated electropolished tubing dries much faster than conventional surfaces.¹

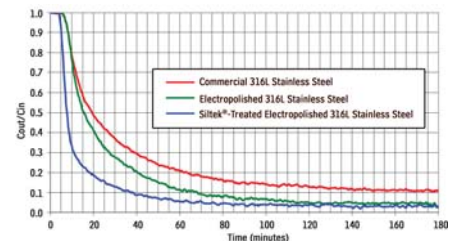


Table 1 Restek treated electropolished tubing provides the shortest drying times.¹

Moisture Concentration		Time Required to Detect Change (min.)		
From	To	Treated Electropolished Tubing	Untreated Electropolished Tubing	Standard Tubing
10ppm*	5ppm	4	5	13
5ppm	1ppm	22	46	71
1ppm	500ppb	40	63	96
500ppb	100ppb	80	103	153
100ppb	50ppb	98	121	---

*Initial moisture concentration.



Restek Performance Coatings

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After the tubing was stabilized with 1ppm of moisture, dry-down properties were measured. Moisture dry-down curves for the three tubing treatments show treated electropolished tubing achieved dry-down in 35 minutes, electropolished tubing required 65 minutes, and standard tubing required 175 minutes (Figure 2). Table 1 compares time to various dry-down levels for tubing saturated with 10ppm of moisture.

In addition to rapid wet-up and dry-down, the other key advantage of Restek treatment for 316L stainless steel is a dramatic improvement in corrosion resistance. The amorphous silicon layer is insoluble in many of the acidic environments encountered in the semiconductor industry. Figures 3, 4, and 5 briefly summarize the results of corrosion testing by ASTM methods. Comparisons between treated and untreated test samples illustrate the improvements in corrosion resistance offered by Silcosteel®-CR treatment. For more information about corrosion resistance, request information packet 59048., or visit our website.

When moisture considerations and corrosion concerns arise in transfer of ultra-high purity gas streams, Restek treated tubing and system components will dramatically improve dry-down, reduce contamination from moisture carryover, and extend periodic maintenance cycles.

Figure 3 In chloride environments, Silcosteel®-CR treated stainless steel outperforms untreated metal by an order of magnitude (ASTM G 48, Method B).

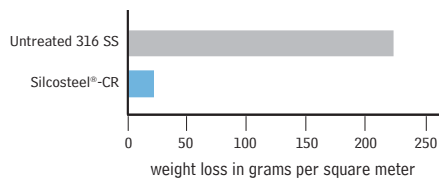


Figure 4 Silcosteel®-CR treated 316L stainless steel coupons show no sign of attack after 4000-hour salt spray exposure, per ASTM B117.

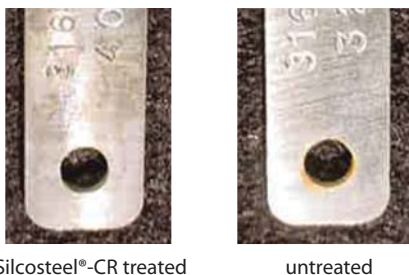
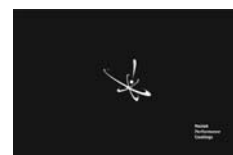


Figure 5 Silcosteel®-CR treated 316L stainless steel coupons show no crevice corrosion and only slight pitting corrosion after 72-hour exposure to ferric chloride; untreated coupons exhibit severe crevice corrosion.



Silcosteel®-CR treated untreated



free literature

Learn more about our precisely applied, highly durable surface treatments: request our brochure lit. cat.# 59493.

Siltek®- and Silcosteel®-CR-Treated Electropolished Tubing

- Exceptional inertness.
- Improved reliability and reproducibility; longer lifetime.
- Use with treated fittings for the most inert sample pathway available.



Siltek®-Treated Electropolished Tubing

ID	OD	cat.#	Price-per-foot			
			5-24 ft.	25-99 ft.	100-299 ft.	> 300 ft.
0.085"	1/8"	22538	\$25/ft.	\$20/ft.	\$16.80/ft.	\$14/ft.
0.180"	1/4"	22539	\$25/ft.	\$20/ft.	\$16.80/ft.	\$14/ft.

Silcosteel®-CR-Treated Electropolished Tubing

ID	OD	cat.#	Price-per-foot			
			5-24 ft.	25-99 ft.	100-299 ft.	> 300 ft.
0.085"	1/8"	22536	\$25/ft.	\$20/ft.	\$16.80/ft.	\$14/ft.
0.180"	1/4"	22537	\$25/ft.	\$20/ft.	\$16.80/ft.	\$14/ft.

Coiled Siltek®- and Silcosteel®-CR-Treated Seamless 316L Grade Stainless Steel Tubing

Siltek®-Treated 316L Tubing

ID	OD	cat.#	Price-per-foot			
			5-24 ft.	25-199 ft.	200-399 ft.	> 400 ft.
0.055" (1.40mm)	1/8" (3.18mm)**	22896	\$18.75/ft.	\$15/ft.	\$12.50/ft.	\$10/ft.
0.180" (4.57mm)	1/4" (6.35mm)**	22897	\$18.75/ft.	\$15/ft.	\$12.50/ft.	\$10/ft.

Silcosteel®-CR Treated 316L Tubing

ID	OD	cat.#	Price-per-foot			
			5-24 ft.	25-199 ft.	200-399 ft.	> 400 ft.
0.055" (1.40mm)	1/8" (3.18mm)**	22508	\$18.75/ft.	\$15/ft.	\$12.50/ft.	\$10/ft.
0.180" (4.57mm)	1/4" (6.35mm)**	22509	\$18.75/ft.	\$15/ft.	\$12.50/ft.	\$10/ft.

*1/8" OD: 5 ft. to 100 ft. in one continuous coil; 1/4" OD: 5 ft. to 300 ft. in one continuous coil. Longer lengths will be more than one coil.
**0.035" wall thickness

We offer a wide variety of **treated fittings** and custom treatment. For information and ordering, call us or visit us online.



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