



Deactivated Sampling and Transfer System Components

Economical solutions for varied sample stream challenges

Restek surface treatments are:

Silcosteel®—A general-purpose passivation layer for steel and stainless steel. U.S. patent 6,511,760.

Silcosteel®-AC—Dramatically reduces carbon buildup on stainless steel components. U.S. patent 6,444,326.

Silcosteel®-CR—A corrosion resistant layer that increases the lifetime of system components in acidic environments containing hydrochloric acid, nitric acid, sulfuric acid, or seawater. Patent pending.

Silcosteel®-UHV—Greatly reduces out-gassing from components of ultra-high vacuum systems. Patent pending.

Siltek®—The ultimate passivation for treated components, from glass to high nickel alloys of steel. U.S. patent 6,444,326.

Sulfinert®—A required treatment for metal components when analyzing for parts-per-billion levels of organo-sulfur compounds. U.S. patent 6,444,326.



tubing reduces uptake by orders of magnitude, relative to untreated stainless steel tubing.

In corrosive environments, Silcosteel®-CR treated tubing is an excellent alternative to expensive alloys. Silcosteel®-CR treatment extends the lifetime of the tubing, reducing the frequency of preventive maintenance and helping to ensure the purity of the process or sample stream.†

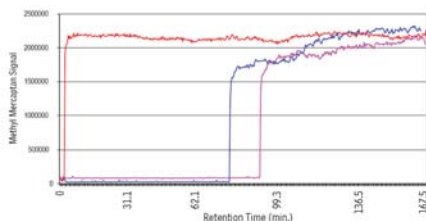


Figure 1 Sulfinert® treated electropolished seamless stainless steel tubing (red) does not adsorb methyl mercaptan (500ppbv). Blue-untreated electropolished tubing; violet-raw tubing.

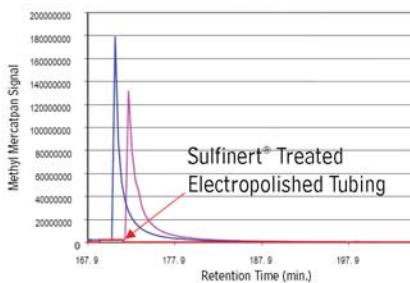


Figure 2 Sulfur memory is prolonged in raw commercial grade stainless steel tubing (violet). Red-Sulfinert® treated electropolished tubing; blue-untreated electropolished tubing. (500ppbv methyl mercaptan in helium)

Table I Applications in which Restek treated sample pathway components minimize corrosion** or prevent adsorption of active compounds*.

Sulfur compounds in:*

- automotive exhaust
- beverage grade CO₂
- diesel fuels
- environmental samples
- ethylene
- gasoline
- liquefied petroleum gas
- natural gas (odorants)
- propylene
- stack gas emissions
- wines and beers

Nitric oxide (NOx) compounds in:*

- automotive exhaust
- stack gas emissions

Mercury compounds in:*

- crude oil
- environmental samples
- exhaust
- stack gas emissions from coal fired electric power plants

Corrosive environments:**

- hydrochloric acid
- hydrogen peroxide
- seawater

Moisture hold-up in high purity sampling lines**

*Siltek®/Sulfinert® treatment.
**Silcosteel®-CR treatment.

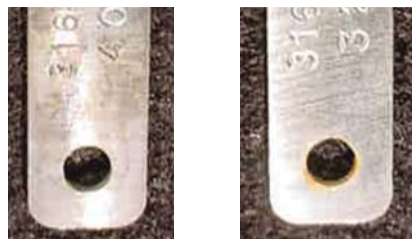
†Note that with any corrosive stream, regular inspections are needed to confirm there are no leaks or breakthroughs.

Figure 3 shows the results of a 4000-hour salt spray test on Silcosteel®-CR treated 316L stainless steel and untreated 316L stainless steel. The Silcosteel®-CR treated material exhibited virtually no change.

Fittings

Connections can be a source of adsorption and sample loss, and there is benefit to using Restek surface treatment on many of these

Figure 3 Silcosteel®-CR treated 316L stainless steel coupons show no sign of attack after 4000-hour salt spray exposure, per ASTM B117.



Silcosteel®-CR treated untreated

Figure 4 Highlighted components of a mercury sampling train,² and all tubing in the system, can be Siltek®/Sulfinert® treated.

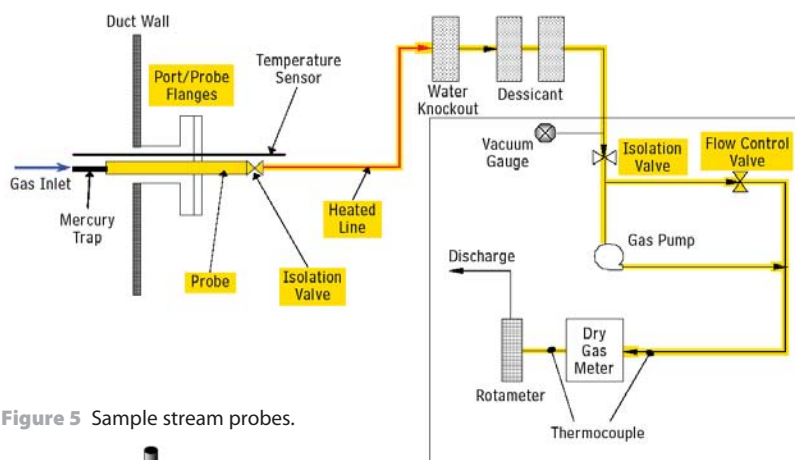


Figure 5 Sample stream probes.



Figure 6 Tubing bundles.



Siltek® and Sulfinert®: What's the Difference?

Siltek® is the name for our patented deposition process. When we developed the Siltek® process, the application that showed the greatest benefit, among many we investigated, was the storage and transfer of low ppb level active sulfur compounds, such as hydrogen sulfide and mercaptans. Because there was (and continues to be) demand for a reliable surface treatment for this application, we use the name Sulfinert® to describe Siltek® treated products created specifically for this purpose.

components. For example, in corrosive environments, Silcosteel®-CR treatment will extend the useful life of system fittings, as it will for tubing. We offer extensive lines of treated Swagelok® and Parker fittings, in sizes from 1/16" to 1/4".

Valves

The sample flow path through a valve can be tortuous, prolonging contact between the sample stream and the valve components. Restek surface treatments have been applied to many valve geometries, to eliminate adsorption to bodies, stems, diaphragms, or other components. To determine if a Restek surface treatment can be applied to valves in your system, contact our Technical Service department, or visit us on the web.

Filters

Frits and other filtering devices trap particles and prevent them from entering the analytical instrument, but they also very effectively adsorb active components in sample streams. Their large surface areas can increase sample/sys-

tem contact by orders of magnitude. Siltek®/Sulfinert® treatment of frits and filters creates an inert flowpath. Our chemical vapor deposition technology ensures the treatment penetrates even the smallest pores in sintered metal frits.

Sample Vessel Equipment

When samples are taken from a process stream and are transported to the laboratory for evaluation, it is critical to use Restek treated sampling containers, to prevent active components from adsorbing to vessel, valve, or outage tube surfaces. We offer a complete line of high pressure sampling equipment for sampling applications involving liquefied petroleum gases, ethylene, or propylene.

Probes

Sampling probes are used in a variety of applications, including sampling natural gas or other process streams (Figures 4, 5). An untreated probe contributes to the active surface area in the system, and this should be considered when identifying potential adsorption sites during active stream transfer.

Heated Lines

A heated "trace line" consists of standard grade or electropolished tubing that has been insulated and bundled with heating devices to ensure the sample is transferred at a consistent temperature (Figure 6). Often, samples are transferred at temperatures greater than 150°C, to prevent condensation of moisture in the line. Such lines are used in many gas stacks and other remote sampling points at which a sample is transported through the outdoor environment. Active compounds in the sample quickly can be adsorbed onto the hot tubing. Restek surface treatment prevents adsorption of active compounds.

Summary

Surface treatments from the Restek Performance Coatings group prevent corrosion or adsorption of active compounds in delivery systems, and always should be considered in applications in which corrosive or active streams are to be sampled, transferred, and analyzed.

for more info

For more information about Restek performance coatings, request lit. cat.# 59493, or visit us online.

References

- ¹Relative Response Time of True Tube™ when Measuring Moisture Content in a Sample Stream Test Report, Haritec Scientific & Engineering Support, Calgary, Alberta, Canada, May 2004. Reference courtesy of O'Brien Canada, available on request from Restek.
- ²Proposed Method 324. Determination of Vapor Phase Flue Gas Mercury Emissions from Stationary Sources Using Dry Sorbent Trap Sampling. United States Environmental Protection Agency. Washington, D.C. p. 5.











www.restekcoatings.com



Siltek®/Sulfinert® and Silcosteel®-CR Treated Fittings from Swagelok®

- Full line of treated 1/16", 1/8", and 1/4" fittings.
- Siltek®/Sulfinert® treatment ensures ultimate inertness.
- Silcosteel®-CR treatment enhances corrosion resistance by 10X, or more.
- Custom treatment available for any Swagelok® fitting or other system parts.



Fitting Type	Size	Similar to Swagelok® #	qty.	Siltek® cat.#	qty.	Silcosteel®-CR cat.#
 Union	1/16"	SS-100-6	ea.	22540	ea.	22575
	1/8"	SS-200-6	ea.	22541	ea.	22576
	1/4"	SS-400-6	ea.	22542	ea.	22577
 Tee	1/16"	SS-100-3	ea.	22543	ea.	22578
	1/8"	SS-200-3	ea.	22544	ea.	22579
	1/4"	SS-400-3	ea.	22545	ea.	22580
 Reducing Union	1/8" to 1/16"	SS-200-6-1	ea.	22546	ea.	22581
	1/4" to 1/16"	SS-400-6-1	ea.	22547	ea.	22582
	1/4" to 1/8"	SS-400-6-2	ea.	22548	ea.	22583
 Elbow	1/8"	SS-200-9	ea.	22549	ea.	22584
	1/4"	SS-400-9	ea.	22550	ea.	22585
 Plug	1/16"	SS-100-P	ea.	22572	ea.	22619
	1/8"	SS-200-P	ea.	22573	ea.	22620
	1/4"	SS-400-P	ea.	22574	ea.	22597
 Cross	1/8"	SS-200-4	ea.	22551	ea.	22586
	1/4"	SS-400-4	ea.	22552	ea.	22587
 Tube End Reducer	1/8" tube to 1/16"	SS-100-R-2	ea.	22553	ea.	22588
	1/4" tube to 1/16"	SS-100-R-4	ea.	22554	ea.	22589
	1/8" tube to 1/4"	SS-400-R-2	ea.	22555	ea.	22590
	1/4" tube to 1/8"	SS-200-R-4	ea.	22556	ea.	22591
 Port Connector	1/8"	SS-201-PC	ea.	22557	ea.	22592
	1/4"	SS-401-PC	ea.	22558	ea.	22593
	1/8" tube to 1/4"	SS-401-PC-2	ea.	22559	ea.	22594
 Male Connector	1/8" to 1/8" NPT	SS-200-1-2	ea.	22561	ea.	22595
	1/4" to 1/4" NPT	SS-400-1-4	ea.	22562	ea.	22596
	1/16" to 1/8" NPT	SS-100-1-2	ea.	22563	ea.	22610
	1/8" to 1/4" NPT	SS-200-1-4	ea.	22564	ea.	22611
	1/4" to 1/8" NPT	SS-400-1-2	ea.	22565	ea.	22612
 Female Connector	1/8" to 1/8" NPT	SS-200-7-2	ea.	22566	ea.	22613
	1/4" to 1/4" NPT	SS-400-7-4	ea.	22567	ea.	22614
	1/4" to 1/8" NPT	SS-400-7-2	ea.	22568	ea.	22615
	1/8" to 1/4" NPT	SS-200-7-4	ea.	22569	ea.	22616
 Bulkhead Union	1/8"	SS-200-61	ea.	22570	ea.	22617
	1/4"	SS-400-61	ea.	22571	ea.	22618

Siltek®/Sulfinert® Treated & Silcosteel®-Treated Parker Plug & Ball Valves



- No adsorption of active compounds at low ppb concentrations.
- Stable, flexible surface deactivation that will not crack or flake.
- Commonly used pathway components now available from stock.

Fitting Type	Size	Siltek®/Sulfinert®-Treated		Silcosteel®-Treated	
		qty.	cat.#	qty.	cat.#
Plug Valve	1/8"	ea.	21586	ea.	21576
	1/4"	ea.	21587	ea.	21577
Ball Valve	1/8"	ea.	21588	ea.	21578
	1/4"	ea.	21589	ea.	21579

Sulfinert®-Treated Sample Cylinders



- Stable storage of samples containing low concentrations of sulfur compounds.
- D.O.T. rated to 1800psi at room temperature.

Size	qty.	cat.#
75cc	ea.	24130
150cc	ea.	24131
300cc	ea.	24132
500cc	ea.	24133
1000cc	ea.	24134
2250cc	ea.	21394

Sulfinert® Treated Alta-Robbins Sample Cylinder Valves



- All wetted parts Sulfinert® treated for inertness.
- Compatible with Sulfinert® treated Swagelok® sample cylinders.
- Large, durable, Kel-F® seat ensures leak-free operation.

Description	qty.	cat.#
1/4" NPT Exit	ea.	21400
1/4" Compression Exit	ea.	21401
1/4" NPT with Dip Tube*	ea.	21402
1/4" NPT with 2850psi Rupture Disk	ea.	21403

*Specify dip tube length or % outage when ordering (maximum length = 5.25" / 13.3cm)

Siltek® Treated Filters



Siltek® 2µm frit filter



Siltek® 7µm in-line filter

Description	qty.	cat.#
Siltek® 2µm Frit Filter	3-pk.	24171
Siltek® 7µm In-Line Filter	ea.	24265



Restek Performance Coatings

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Treated Electropolished Tubing

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



Siltek®/Sulfinert® Treated Coiled Electropolished 316L Grade Stainless Steel Tubing

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

Silcosteel®-CR Treated Coiled Electropolished 316L Grade Stainless Steel Tubing

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

Treated Seamless Tubing

Siltek®/Sulfinert® Treated Coiled 316L Grade Stainless Steel 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				
0.180" (4.57mm)	1/4" (6.35mm)**	22509				

Silcosteel®-CR Treated Coiled 316L Grade Stainless Steel 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				
0.180" (4.57mm)	1/4" (6.35mm)**	22897				

1/8" OD: 5 ft. to 100 ft. in one continuous coil; 1/4" OD: 5 ft. to 300 ft. in one continuous coil.

**0.035" wall thickness

Siltek®/Sulfinert® Treated Straight Seamless 316L Grade Stainless Steel Tubing

6 foot Length

ID	OD	qty.	cat.#
0.055" (1.40mm)	1/8" (3.18mm)*	ea.	22901
0.180" (4.57mm)	1/4" (6.35mm)*	ea.	22902
0.277" (7.04mm)	3/8" (9.52mm)**	ea.	22903

Silcosteel®-CR Treated Straight Seamless 316L Grade Stainless Steel Tubing

6 foot Length

ID	OD	qty.	cat.#
0.055" (1.40mm)	1/8" (3.18mm)*	ea.	22898
0.180" (4.57mm)	1/4" (6.35mm)*	ea.	22899
0.277" (7.04mm)	3/8" (9.52mm)**	ea.	22900

Silcosteel® Treated Straight Seamless 304 Grade Stainless Steel Tubing

- Ideal for adsorbent traps, thermal desorption tubes, transfer lines, and instrument interfaces.
- Easily cut to specific lengths using a standard tubing cutter.
- Available in individual 18"/457mm pieces or in economical 5-packs.

18" (457mm) Length

ID	OD	qty.	cat.#
0.085" (2.16mm)	1/8" (3.18mm)	ea.	20575
0.085" (2.16mm)	1/8" (3.18mm)	5-pk.	20576
0.210" (5.33mm)	1/4" (6.35mm)	ea.	20577
0.210" (5.33mm)	1/4" (6.35mm)	5-pk.	20578

*0.035" wall thickness **0.049" wall thickness

Restek offers **tapes, tools, and accessories** to make installing and maintaining your tubing system easier. Request catalog 580021 or visit us online.



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