Applications Note

Reliable sampling at the well or in the refinery

SilcoTek® surface treatments improve sampling and transfer component performance

- **Economical** - Low cost corrosion resistance compared to specialty alloys, more durable than traditional stainless steels.
- **Productive** - Superior analytical performance allows characterization of parts-per-billion level sulfurs in the field or lab.
- **Versatile** - Suitable in a variety of environments and at extreme temperature ranges.
- **Simple** - Can be applied to existing equipment.

When corrosion and surface activity are a concern, solutions must be engineered using special alloys or surface treatments. SilcoTek offers a family of surface treatments that address reactivity and corrosion concerns over a wide spectrum of applications. Table 1 lists applications in which SilcoTek treatments minimize corrosion or prevent adsorption of active compounds.

Table 1 Applications in which SilcoTek treated sample pathway components minimize corrosion** or prevent adsorption of active compounds*.

Sulfur compounds in:*
automotive exhaust
diesel fuels
ethylene
liquefied petroleum gas
oil & gas exploration
refining
wines and beers
beverage grade C02
environmental samples
gasoline
natural gas (odorants)
propylene
stack gas emissions

Nitric oxide (NOx) compounds in:*
automotive exhaust
stack gas emissions

Mercury compounds in:*
crude oil refiningenvironmental samples
exhaustoil & gas exploration
stack gas emissions from coal fired electric power plants

Corrosive environments:**
hydrochloric acidhydrogen peroxide
off-shore platformsrefining
seawater

Moisture hold-up in high purity sampling lines**
sample systems
gas delivery systems
process systems

*SilcoNert®2000 treatment. **Silcolloy®1000 treatment.

Detect process upsets

Accurate sampling every time with SilcoNert® 2000 (Siltek/Sulfinert) treated components.

Reduce capital costs

Silcolloy® (Silcosteel®-CR) treated compenents cost up to 85% less than super alloys.

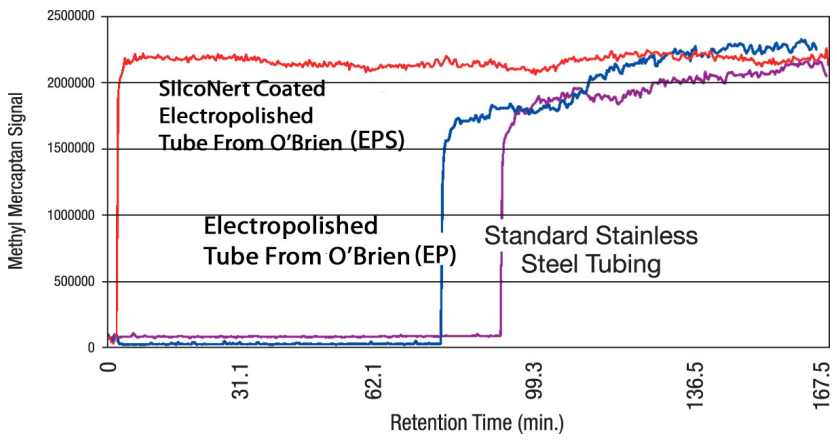
Reduce maintenance costs

Increase component life by 10X over untreated stainless steel.

Accurate feedstock or process sampling the first time, every time with SilcoNert® 2000(Siltek®/Sulfinert®) tubing and fittings.

Adsorption problems in sample pathways often can be traced to the tubing and fittings used to transfer the sample to the analytical instrument. Always use treated tubing and fittings for applications involving active compounds. For special requirements, ensure maximum inertness and minimal surface area by applying SilcoTek treatments to electropolished tubing. Figure 1 shows uptake and release curves for 500ppbv of methyl mercaptan, an active sulfur compound, in a gas stream passing through a variety of tubing substrates.[1] SilcoNert 2000 (Siltek/Sulfinert) treated tubing reduces uptake by orders of magnitude, relative to untreated stainless steel tubing.

Figure 1 SilcoNert 2000 treated tubing allows for rapid detection.



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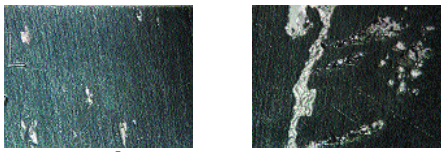
Reduce maintenance cost, extend stainless steel system life with Silcolloy®1000 Treated tubing and fittings.

In corrosive environments, Silcolloy®1000 treatment is an excellent alternative to expensive alloys. Silcolloy 1000 treatment extends component life while reducing the frequency of preventive maintenance and ensuring the purity of the process or sample stream.† Silcolloy 1000 improves corrosion resistance by up to 10X over untreated 316 stainless steel (per ASTM G48 Method B, Figure 2).

Figure 2 Silcolloy 1000 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 (per ASTM Method G48, Method B).



Silcolloy®1000 treated **untreated**

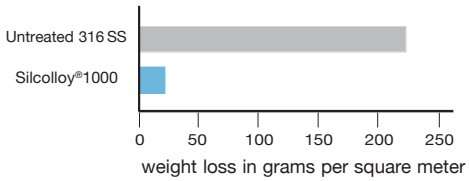
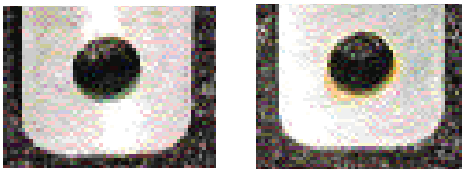


Figure 3 shows the results of a 4000-hour salt spray test on Silcolloy 1000 treated 316L stainless steel and untreated 316L stainless steel. The Silcolloy 1000 treated material exhibited virtually no change.

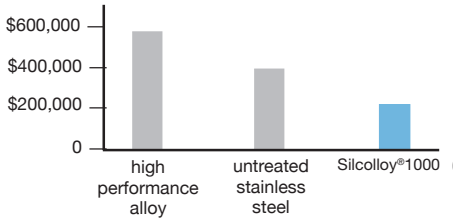
Figure 3 Silcolloy 1000 treated 316L stainless steel coupons show no sign of attack after 4000-hour salt spray exposure, per ASTM B117.
Note rust at aperture on untreated coupon.



Silcolloy 1000 treated **untreated**

Figure 4, a comparison of lifetime costs in a typical process system, shows Silcolloy 1000 treatment can reduce the overall lifetime cost of the system by hundreds of thousands of dollars. While the initial cost of an unprotected stainless steel system is lower than that of a comparable Silcolloy 1000 system, the overall lifetime cost, considering replacement cost due to corrosion, is nearly double that of a Silcolloy 1000 treated system. Conversely, high performance alloy systems offer superlative corrosion performance, but the initial material cost can be up to six times that of a comparable stainless steel system. Silcolloy 1000 treatment has extended the life of process systems in oil and gas production, oil refining, petrochemical processing, aerospace equipment, food and beverage processing, and laboratory testing.

Figure 4 Silcolloy 1000 demonstrates significant cost savings, compared to untreated stainless steel or alloys (US dollars).



Treat the entire sample pathway for maximum effect.

Fittings, valves and other system components can significantly contribute to adsorbtion and corrosive attack. SilcoTek treatment of the entire pathway will reduce costly sample loss or corosion.

Fittings

Connections can be a source of adsorption and sample loss, and there is benefit to using SilcoTek surface treatment on many of these components. For example, in corrosive environments, Silcolloy 1000 treatment will extend the useful life of system fittings, and tubing.

Valves

The sample flow path through a valve can be tortuous, prolonging contact between the sample stream and the valve components. SilcoTek surface treatments have been applied to many valve geometries, to eliminate adsorption to bodies, stems, diaphragms, or other components.

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/system contact by orders of magnitude. SilcoNert 2000 (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 SilcoTek treated sampling containers, to prevent active components from adsorbing to vessel, valve, or outage tube surfaces.

Probes

Sampling probes are used in a variety of applications, including sampling natural gas or other process streams. 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. 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 tubing. SilcoTek surface treatment prevents adsorption of active compounds.

Summary

Surface treatments from SilcoTek prevent corrosion or adsorption of active compounds in process systems, and should be considered in applications in which corrosive or active streams are to be sampled, transferred, or analyzed. To learn more about how SilcoTek can improve the performance of your system, go to www.SilcoTek.com or call us! 814-353-1778.

Free evaluation

For a free treated 316L stainless steel test coupon, visit www.SilcoTek.com. Or call us at 800-356-1778 to arrange treatment of your existing components.

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

1. Application of TrueTube™ in Analytical Measurement Cardinal UHP August 2004

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