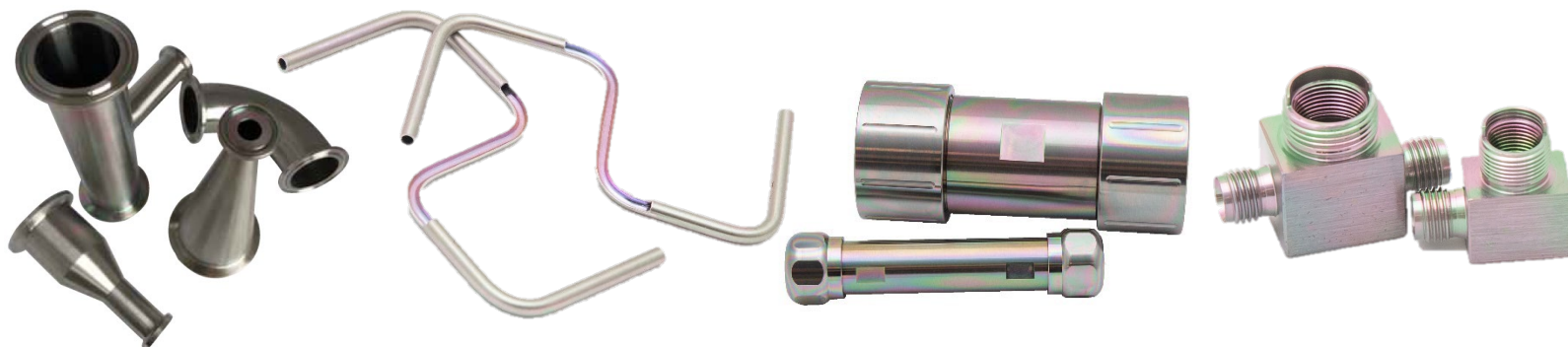


Game-Changing Surface Treatments for Stainless Steel Bioprocessing Equipment

Increase system longevity, performance, and purity without exotic alloys.



Electropolished and passivated alloys are no longer enough for increasingly sensitive, complex, and costly biopharmaceutical processes. Even the smoothest stainless steel or exotic alloys are prone to microscale reactions with process fluids that lead to expensive downtime, lower efficiency, and maintenance.

Fluid contact with metal surfaces should be eliminated to maximize output, performance, and purity, but metal alloys are a must-have for BPE. How can end users and manufacturers of bioprocess systems achieve both?

Surface technology from SilcoTek® that makes stainless steel:

- Corrosion and rouge resistant to fluids at any pH 0-14
- Twice as durable
- Self-cleaning and easier to maintain
- Inert to the most coveted metal-sensitive compounds of interest, like oligonucleotides

SilcoTek's surface technology is trusted by manufacturers of semiconductors, medical devices, analytical instruments, and other high technology applications where purity and performance are of utmost importance. Reasons include:

- **Surface treatment is FDA compliant, USP Class VI and NSF certified**
- Applicable to any BPE flow path component, including tubes up to 24' long
- Penetrates and bonds to equipment surfaces molecularly, preventing flaking
- Does not change ASME-BPE surface designation, can be applied to SF0-SF6
- Vapor phase surface treatment process uniformly treats 100% of surfaces
- Significantly lower cost and lead time than exotic alloys
- Easy process – send SilcoTek® your equipment and we handle the rest

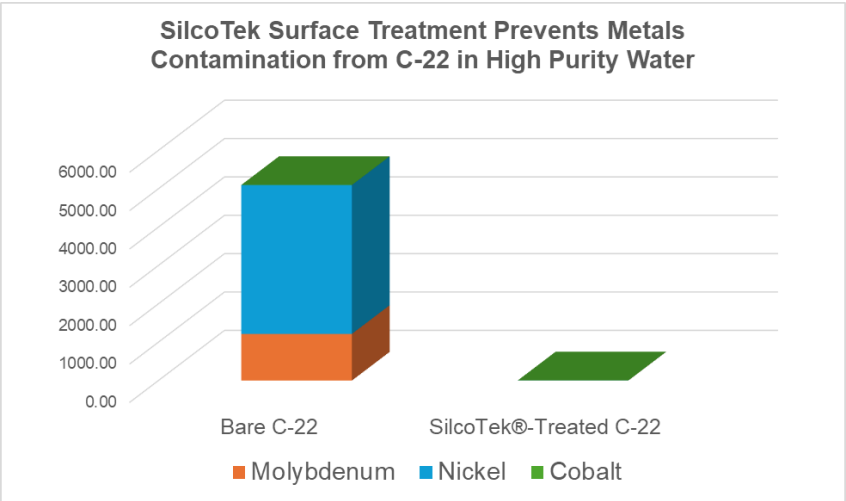
| Key Criteria | SilcoTek®-Treated Stainless Steel | Polymer Coatings | Electropolished Stainless Steel | C-22 and AL-6XN |
|-------------------------------------|-----------------------------------|------------------|---------------------------------|-----------------|
| Resistance to rouging and corrosion | Excellent | Excellent | Good | Excellent |
| Ease of cleaning | Excellent | Fair | Good | Fair |
| Inertness to sensitive compounds | Excellent | Excellent | Poor | Poor |
| Adhesion and durability | Excellent | Poor | N/A | N/A |
| Cost and Lead Time Effectiveness | Excellent | Good | Excellent | Poor |

| SilcoTek® Surface Treatment Properties | |
|--|---|
| Composition | Amorphous silicon, oxygen, carbon ($a\text{-SiO}_x\text{:CH}_y$) |
| Surface Treatment Process | Thermal chemical vapor deposition (CVD) |
| Maximum Use Temperature | 450° C (842° F) |
| Application Details | Compatible with stainless steel, exotic alloys, glass, and ceramics |
| | Applicable to tubes up to 24' long, other parts up to 80" |
| | Uniformly coats any shape, surface feature, and aspect ratio |
| Thickness | 0.4µm – 1.6µm |
| Hydrophobicity (water contact angle) | ≥ 81° |
| Allowable pH exposure | 0 – 14 |

SilcoTek®-treated 316L stainless steel eliminates rouging in guanidine hydrochloride (left) and even prevents metal contaminants that leach from C-22 in the presence of high purity water (right).



Untreated 316L SS SilcoTek®-treated 316L SS



About SilcoTek

SilcoTek® develops and applies patented coating and surface treatment technologies to customer-supplied products from an 80,000 square foot ISO 9001:2015 certified facility in central Pennsylvania. SilcoTek’s service offering includes:

- CVD coating services at industrial scale
- Citric passivation for stainless steel
- ISO 6 Class 1000 cleanroom packaging and cleaning
- Materials analysis and testing using XPS, SEM, more
- Custom tooling and fixturing for processing parts
- Kitting, serialization, custom data records, etc.



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