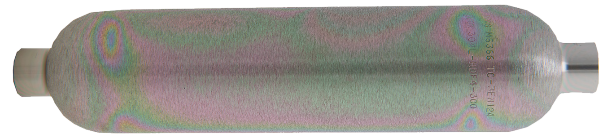


## SilcoTek Coating Success and Care Guide

# Part Surfaces

### Surface Finishes

- [Electropolished](#) surface coating considerations:
  - Thorough rinsing and neutralization are the key to having a properly coated electropolished surface.
  - Passivation is a highly recommended post-electropolish treatment to improve corrosion resistance and preparation for SilcoTek coating. See more under SilcoTek Treatment Processes.
  - Dry electropolish process considerations: If performed improperly, dry electropolishing will leave invisible microdeposits of the electrolyte bead resin (typically styrene / divinylbenzene copolymer) on the part surface. Dry electropolished parts must be properly rinsed post-processing to ensure a surface without any copolymer residue. Contact your dry electropolish provider for proper guidance.
- Buffing/mechanical finishing: As mentioned in ASME BPE specifications, mechanical buffing as a final polishing finish may trap buffing compound underneath microfolds in the surface which may then cause poor coating growth and/or adhesion. Even thorough rinsing with hot DI water after polishing will likely not mitigate contamination risks.
- [Surface roughness](#): SilcoTek processes will effectively coat any level of surface roughness/smoothness without changing surface finish designation (e.g. ASME BPE.) Surface cleanliness is the primary driver for a successful coating process.
- [Brass crossover contamination](#) from shared cutting tools: If a machine shop works both brass and stainless-steel parts, shared tooling from brass processing will embed brass microparticles (which contain copper) in to the stainless steel parts. This results in poor coating.
- Cutting oils/cooling fluid and brass contamination: If cooling/cutting fluids are shared among tools used to machine both brass and stainless-steel parts, the brass-contaminated fluid will allow brass to embed within machined stainless steel.
- [Wire EDM](#): Do not use brass as the EDM wire.



### Pre-used or Precoated Parts

Pre-used parts may retain contamination.

- Field-use contamination: If a part has been in use and retains process contamination, SilcoTek requires the customer to fill out a declaration of health and safety (contact [Customer Service](#)). This is to ensure the safety of SilcoTek employees during the receiving and surface preparation of customer parts. It also allows us to determine the optimal surface preparation strategy.
- Rust:
  - Iron oxide rust is not compatible with SilcoTek processing, and coating over the top of it will result in localized: delamination, incomplete deposition, active sites for corrosion initiation, and/or poor inertness.
  - Additional treatments can be applied to [remove rust](#) prior to shipment to SilcoTek.

Precoated parts should see the following for compatibility adherence.

- Metal plated surfaces (and other pure metals). See [Substrate Compatibility List](#).
- Copper plate (and pure copper) is not compatible, but many copper alloys like [Monei](#) can be coated. It is important to know if copper is present as SilcoTek needs to use proper protocol to process these alloys.

- [Nickel plate](#) is not compatible (but nickel alloys are compatible; consult SilcoTek for coating pure nickel, recent advances may allow for coating).
- Galvanized metal (and any significant concentration of Zinc in particular) is not compatible.
- [Silver/gold plating](#) is compatible if the metal is pure and of high quality. Please contact us for more information.
- Chromium plate is usually compatible.
- Delamination due to a TCE (thermal coefficient of expansion) mismatch can be a potential risk when placing a SilcoTek coating over another coating.
- CVD/PVD/ALD/Anodized
  - SilcoTek has successfully coated over several different types of other depositions. Please consult with our experts.
  - Coating [anodized aluminum](#) is possible when anodization is performed properly.
    - Dyes that are commonly applied to aluminum after the anodization process are incompatible with our process.
- Paint/labels/silicones/waxes/greases/epoxies/caulk/sealants
  - These materials are incompatible with SilcoTek processing and must be removed by the customer prior to coating.

### Pre-heating Treatment of Coated Parts for High-Temperature Applications

For high temperature applications where stainless steel parts will exceed 700°C in use, we recommend heat treatment prior to our coating process. SilcoTek works with a vacuum heat treating service provider near our facility in Pennsylvania to perform this process that has shown great results after our coating. This pre-heat treatment is recommended to harvest the full potential of SilcoTek's silicon coating for high temperature applications. The data behind this recommendation can be found [here](#).

### Pre-Coating Preparation Capabilities

#### Citric Acid Passivation Services

- When applicable (based on part size and end-use), SilcoTek will passivate stainless steel parts using citric acid per ASTM method A967 prior to coating. Surface cleanliness is critical to coating success, and passivating metal parts before coating creates an optimized coating surface to increase corrosion resistance and overall performance of coated parts. SilcoTek's passivation services include Citric 2 Passivation per ASTM A967 standards, sonicated tanks with flow-through capability, forced air drying, and robust quality assurance and control using copper sulfate tests. For more information on passivation for corrosion protection, [click here](#).



### Surface Preparation and Precision Cleaning Services

- SilcoTek surface preparation methods are designed to minimize contamination from oils and other contaminants. Customers requiring additional cleaning methods should notify SilcoTek for requirements beyond the following methods:
- Vapor Stripping – Precision cleaning; size limitations apply.
- Ultrasonic Cleaning – Precision cleaning in ultrasonic cleaning baths.

### Metal Working

- Tubing cutting and deburring services.
- Tooling/fixtures design and fabrication.

### Material Analysis Capabilities

SilcoTek has an array of material analysis services that may be available upon request to our customers depending on their application needs. Capabilities include:

- Fourier Transform Infrared Spectroscopy (FT-IR): Nicolet Model iS20
- Filmetrics F20 and F40 Spectroscopic Thickness Analysis
- Electrochemical Impedance Spectroscopy (EIS): Gamry Series G 300 Potentiostat/Galvanostat
- Goniometer: Ramé -Hart Model 200
- Tensiometer: Kruss K100
- Cyclic Salt Fog Chamber: Weice Testing Instrument WTS90+C
- Non-destructive Metal Composition Analysis: Evident Vanta and Niton XL3 XRF Analysis

SilcoTek staff scientists are also trained to work with our partners and neighbors at [Pennsylvania State University](#) to conduct further in-depth analysis using the following services:

- Raman spectroscopy to analyze coating crystallinity and bonding moieties.
- ICP-MS to measure coating purity and barrier performance.
- TEM for assessing coating microstructure and layer thicknesses.
- XPS to analyze coating composition and depth profile
- SEM/EDS to assess surface coverage, composition, and purity.
- AES to analyze coating composition and depth profile
- FIB SEM or TEM for thickness and layer analysis.
- Profilometry for surface roughness analysis.

