How to Choose the Right SilcoTek Coating

Live Webinar

September 17, 2015

Coating Services that Expand Material Limits

Outline

- When a SilcoTek coating can help you
- Quick overview of coatings
- Important considerations when choosing
- Coatings and their common applications

When a SilcoTek Coating Can Help You

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When our coatings can help

- When analyzing sulfur, mercury, ammonia, or other highly active compounds
- When PTFE is not physically suited for your sampling application
- When you need to protect stainless steels, other alloys, or even exotic materials from corrosion or chemical reactivity

When our coatings can help

- When you need a hydrophobic surface
- When build-up of unwanted molecules (fouling) is causing a problem
- When you need a surface that's easier to clean and rinse

When our coatings can help

- When you need a coating that won't affect tolerances and can penetrate narrow orifices
- When you need a flexible, molecularly bonded protective layer
- When you need more efficiency, longer component life, and better results

When a SilcoTek Coating Cannot Help

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When our coatings can’t help

- When you’re dealing with HF or hot sulfuric acid
- When your substrate isn’t compatible or the parts are too large
- When regulatory bodies (e.g. NACE MR0175) require substrates, not coatings

SilcoTek's CVD Coatings

Dursan®

SilcoNert® 2000

Silcolloy®

SilcoKlean®

SilcoNert® 1000

SilcoGuard®

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SilcoNert® 1000

- The original Silcosteel®
- Prevents your process stream or sample from reacting with your instrument's flow path
- Inert for analytical use above ppm levels
- Useful when only a simple non-reactive barrier is desired

SilcoGuard®

- Achieves better pump-down or wet-up rates in vacuum applications
- Prevents leaching of ions from metallic substrates is important
- Reduces the impact of moisture in vacuum environments

Silcolloy®

- Resists corrosion from acidic media: HCl, nitric acid, etc.
- Ideal for high temperature oxidation/corrosion resistance
- Often chosen for high purity applications

SilcoKlean®

- Prevents carbon build-up as a result of metal surfaces catalyzing fuel into carbon deposits
- Improves maintenance cycles and fuel efficiency
- Ideal for injectors, fuel lines, nozzles, pistons, etc.

SilcoNert® 2000

- A.K.A. Sulfinert®
- Required when analyzing active compounds at sub-parts-per-million concentrations
- Especially important for sulfurs, Hg, & ammonia
- The industry's chosen solution for adsorption

Dursan®

SilcoTek® Driving Innovation

- The most versatile coating available
- Inert like SilcoNert 2000, but also suited for full pH range, corrosion, wear, bioanalysis, etc.
- Low surface energy: hydrophobic (110°), easy to clean. Can be steam cleaned.

Things to Consider when Choosing a Coating

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Temperature

- Coatings are applied at 400-450° C
- Silicon-only coatings (SilcoNert 1000, SilcoGuard, Silcolloy) remain intact up to ~1400° C
- Don't exceed 450° C with Dursan or SilcoNert 2000

Temperature

- Functionalization is lost above deposition temperature UNLESS…
- Parts are pre-heated at their application temperature in an inert atmosphere
- SilcoKlean's properties have been tested effective at 1000° C, but be mindful of the need for tempering the substrate first

pH

- Silco- coatings are limited to use in pH 0-8
- Basic media common in refining, chemical processing, etc. will degrade a Silco- layer
- Dursan is the only coating suitable for protection from the full pH range 0-14

Analytical

- The materials of instrument flow paths adsorb enough active molecules to give you poor results
- SilcoNert 2000 and Dursan produce the most inert flow paths available in chromatography
- The level of your analysis and compounds of concern impact coating selection

Analytical

- For common profiles where analysis below 25 parts-per-billion (ppb) is needed, use SilcoNert 2000

- Dursan can be used to low ppb for H_2S, methyl mercaptan, etc., but inertness testing with mercury and ammonia is still ongoing

Analytical

- Dursan is now a solution for bioanalytical profiles common in liquid chromatography and medical diagnostics
- Dursan is highly resistant to “big” molecules like protein and hemoglobin
- Dursan is becoming an all-in-one analytical solution

Corrosion

- Every corrosion application is different
- Dursan is the most recommended solution, but others sometimes work better depending on overall application needs
- Dursan is required in oxidizing corrosive environments e.g. bleach

Corrosion

- Silcolloy offers comparable corrosion resistance to acidic media
- Silcolloy is ideal in semiconductor applications (no carbon)
- Lots more data to come - Dursan is the corrosion leader

Corrosion + Analytical

- In analytical applications with corrosives in the sample, consider pH first
- If pH>8, choose Dursan
- If pH<=8, evaluate need for corrosion protection vs. level of analysis required

Corrosion + Analytical

- SilcoNert 2000 is more inert
- If corrosion is not the primary concern in a “hybrid” application, SilcoNert 2000 is ideal
- If you’re not below 25ppb and corrosion is a problem, choose Dursan

HF

- HF is common in sampling applications
- Coatings alone are not a solution, but base substrate has the biggest impact on lifetime
- SilcoNert 2000/Sulfinert-coated Hastelloy® C-series is commonly recommended

Abrasion

- Dursan is the only coating that offers wear resistance (2x that of 304 SS)
- Light rubbing with an abrasive pad will remove the Silco- coatings
- Dursan will not resist heavy metal-on-metal abrasion. It is best suited for valve components and wearing environments

Carbon Fouling

- Dursan or SilcoKlean
- SilcoKlean works best for carbon build up that is catalyzed by the substrate
- Dursan is better for “varnishing” or “lacquering” forms of coking common in oxidizing fuel applications

Moisture

- Dursan is the most hydrophobic with a contact angle of ~110˚
- All other coatings are in the 60-85˚ range
- SilcoNert 2000 is adequate for sampling system moisture

Cleaning

- Do not steam clean any Silco- coating!
- Rinse coated parts with a solvent that will dissolve surface contaminants
- Avoid abrasives or excessive sonication

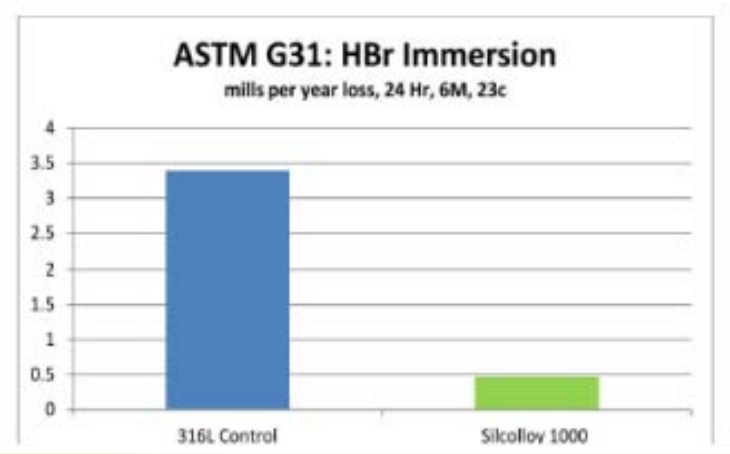
Substrates

- All SilcoTek coatings can be applied to the same substrates
- Stainless steels, titanium, high nickel alloys, exotic metals, most grades of aluminum, glass and ceramics can be coated
- Copper, nickel plating, gold, silver, zinc, bronze, and low temp materials can’t be coated

Coatings and Typical Applications

Silcolloy®

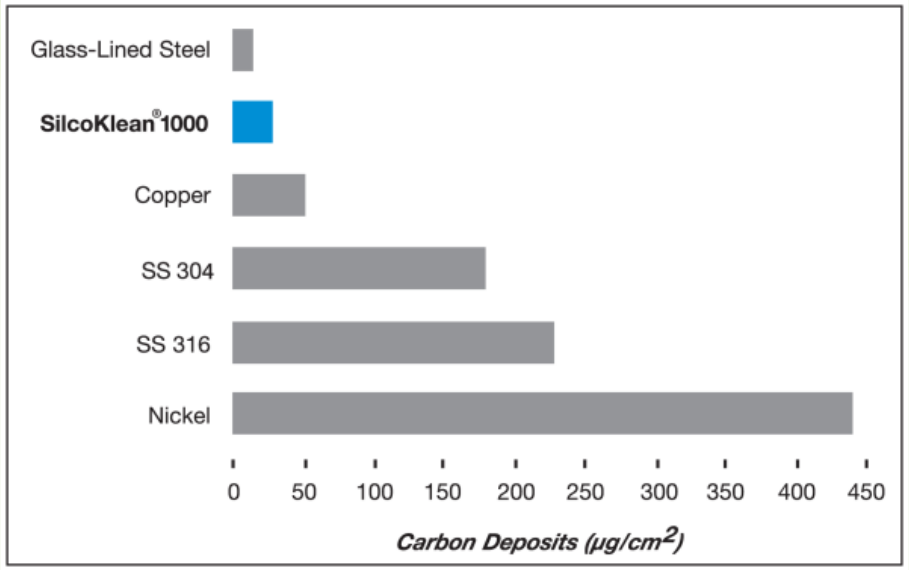
- HCl-containing streams
- Nitric acid-containing streams
- Seawater environments
- Semiconductor gas transfer
- Stack gas monitoring
- SO_2



SilcoTek
Driving Innovation

SilcoKlean®

- Fuel systems in automotive and aerospace
- Gas turbines
- Stationary power
- Refining and stack sampling
- Engine nozzles
- Pistons



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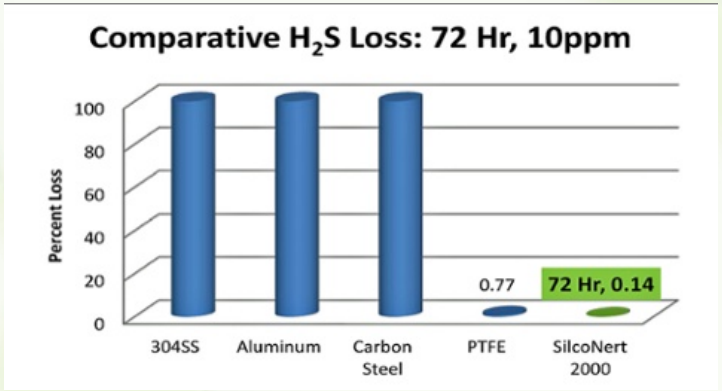
SilcoNert® 2000

- Sulfurs, mercury, ammonia, and other highly reactive compounds
- Sample transfer tubing
- Beverage-grade CO2 testing
- Environmental and headspace sampling
- Liquid petroleum gas
- Natural gas testing
- NOx monitoring



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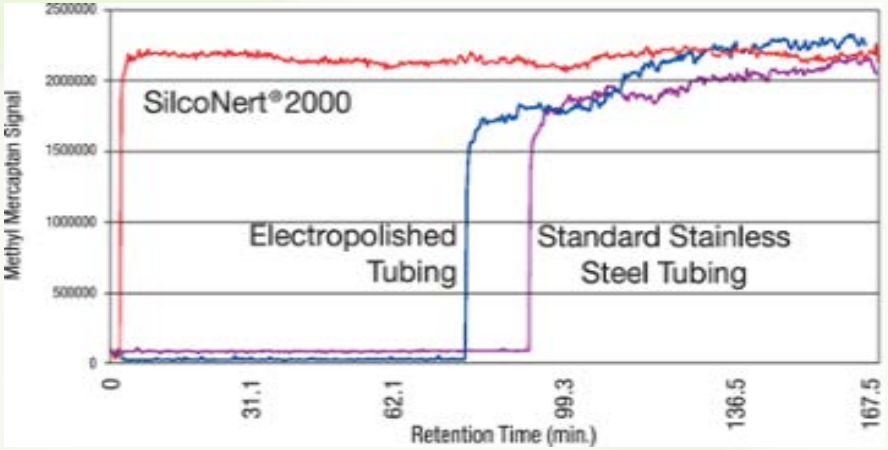
SilcoNert® 2000

- Odorant testing
- SOx monitoring
- Stack gas monitoring
- Sulfur dioxide
- EPA sulfur compliance
- Polar adsorptive organics

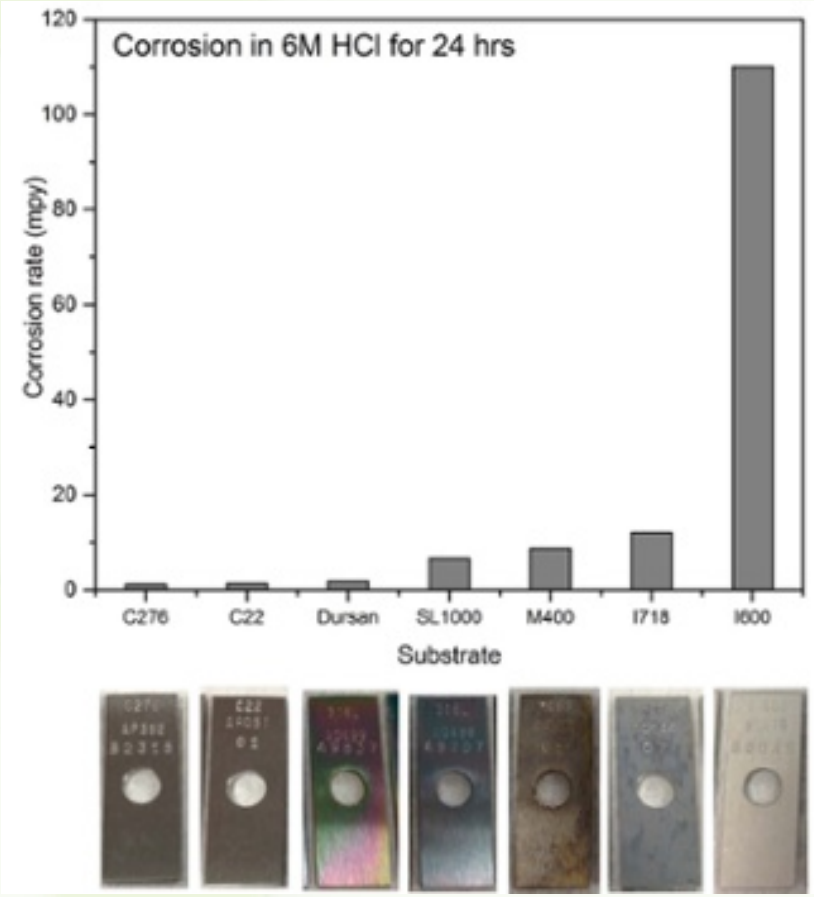


- All SilcoNert 2000 applications EXCEPT mercury and ammonia (testing not complete)
- Downhole oil and gas sampling/testing
- Bio / medical diagnostic / pharma; HPLC
- Corrosion

Dursan®

SilcoTek® Driving Innovation

- Exhaust gas testing
- Salt cycle
- Subsea, surf and splash zone
- Bleach
- Food and beverage



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In Review

Review

- Often times, multiple – or even all – SilcoTek coatings will work
- Some unique applications have specific solutions
- Dursan, SilcoNert 2000 or Silcolloy are most often recommended

Review

- Dursan is an all-in-one coating solution in many cases

- While SilcoNert 2000 is the gold standard for inert coatings, Dursan:
  - Shows similar inertness to SilcoNert 2000
  - Exceeds competitor inert coating performance
  - Also offers physical benefits that many have yet to experience from SilcoTek or industry in general

Thank you for watching!

- A link to the webinar recording as well as the slides will be emailed to you by tomorrow
- Please contact our technical team (I'm included) at SilcoD@SilcoTek.com for specific questions
- Be on the lookout for future webinars!

Resources

- Get a quote (or email SilcoD@SilcoTek.com)
- Technical resources
  - Application guide
  - Material compatibility
  - App. Notes, data sheets, webinars, etc.
- Call us: 814-353-1778 (then 2 for tech.)