

Non-stick, Anti-coking,  
Anti-fouling, Anti-sludge

SilcoKlean®1000 formerly Silcosteel®-AC

**SilcoTek® surface treatments inhibit catalytic coking and carbon fouling.**

## SilcoKlean® 1000 treatment adds value to your process:

- Inhibits catalytic coking
- Longer component lifetimes
- Decreased maintenance costs
- Higher thermal efficiency
- Will withstand temperatures over 600°C
- Apply to existing equipment

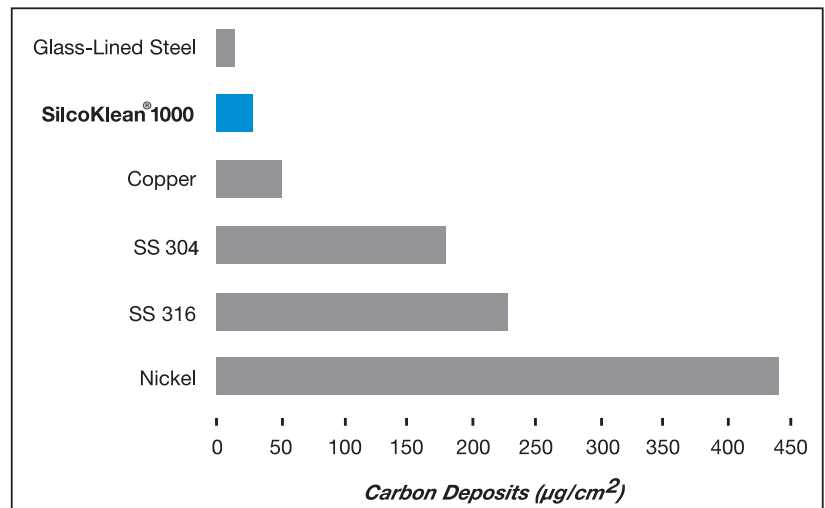


**Figure 3** A SilcoKlean1000-treated piston (left) shows dramatically less coke buildup than an untreated diesel piston (right).  
Data courtesy of The Pennsylvania State University.

## Reduce coke formation 8-fold with SilcoKlean® 1000 surface treatment

SilcoKlean®1000 reduces the formation of coke by preventing exposed metal surfaces from catalyzing fuel into carbon filaments. Figure 1 compares the carbon buildup on various surfaces. SilcoKlean 1000 reduces carbon fouling or coking by 8-fold when compared to an uncoated 316 stainless steel surface.

**Figure 1** SilcoKlean 1000 treatment reduces coking up to 8-fold.<sup>2</sup>  
Data courtesy of The Pennsylvania State University.



A SilcoKlean 1000 treated surface not only prevents the formation of filamentous coke, it simplifies removal of other types of coke that typically bind to a heated surface.

Studies have shown that carbon deposits can be removed from a SilcoKlean 1000 treated surface simply by sonicating the surface in common solvents, thus dramatically simplifying maintenance procedures and extending maintenance cycles.<sup>3</sup> (Figure 2)

SilcoKlean 1000 treatment extends maintenance cycles for engines while maintaining high dimensional tolerances, high temperature capability, and leak-free conditions, making it an ideal treatment for:

- fuel injection nozzles
- fuel and oil lines
- jet engine nozzles
- pistons
- EGR systems
- valves
- turbine shafts
- heat exchangers



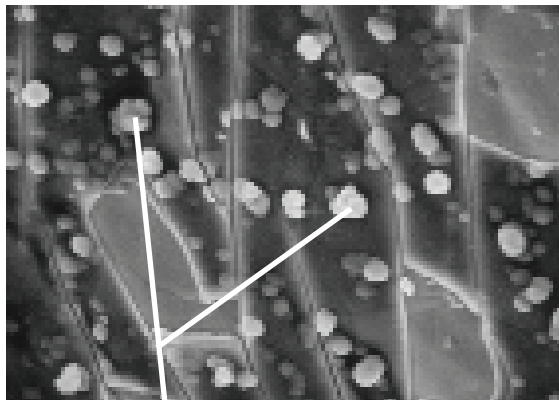
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An important contributor to high maintenance costs is a buildup of carbon-based deposits on combustion related components or process systems known as carbon fouling, or coking. Coking has been responsible for engine failures, shortened maintenance cycles, and unplanned repairs. For example, diesel engine manufacturers have determined that coking on pistons is a contributor to shortened engine life and costly rebuilds (Figure 3).<sup>1</sup> Aircraft maintenance personnel are discovering significant coking in fuel lines, oil lines, and nozzles.

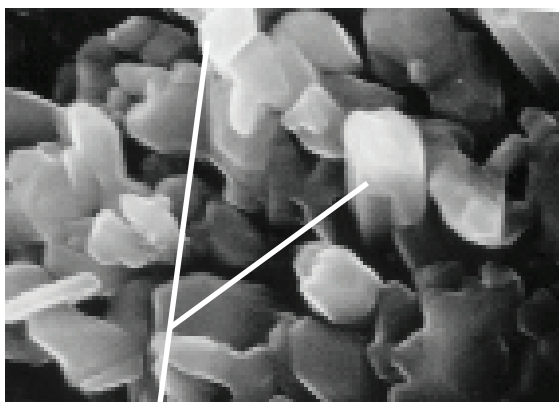
**Figure 2** Carbon deposit from JP-8 fuel on various types of tubing (500°C, 500psi, 1cc/min. flow rate). Data courtesy of The Pennsylvania State University.

**SilcoKlean 1000**



Carbon nucleation lands on surface but can easily be removed from a SilcoKlean 1000 surface.

**304 Stainless Steel**



Untreated stainless steel promotes carbon filament growth that cannot be removed with sonication.

Studies have shown that coking occurs when fuels or oils are exposed to temperatures over 200°C, and increases significantly at temperatures over 400°C. Frequently, exposure to high temperature occurs after the engine or process is shut down, when there is no coolant flow to carry away excess heat.<sup>2</sup>

### Apply SilcoKlean 1000 treatment to components susceptible to coking

SilcoKlean 1000 is a chemical vapor-deposited (CVD) layer, designed specifically to reduce coking of steel, stainless steel, and specialty alloys. The unique non-line-of-sight CVD process produces a flexible, amorphous silicon layer that diffuses into the metal lattice and conforms to the most intricate surface, while maintaining high dimensional tolerances.

SilcoKlean 1000 layer will flex with the metal surface, and form leak-free seals, even at the most demanding temperatures.

### In Summary

Test data show that SilcoKlean 1000 treatment is highly effective in reducing catalytic coking, by as much as a factor of 8. Because SilcoKlean 1000 treatment can be applied to existing components, maintenance cycles can be extended without significant re-engineering. SilcoKlean 1000 treatment is a proprietary (U.S. patent 6,444,326), custom service, offered by SilcoTek.

To learn more about how SilcoKlean 1000 treatment can reduce coking in your process or engine fleet, visit SilcoTek on the web at [www.SilcoTek.com](http://www.SilcoTek.com) or contact our technical service group at 814-353-1778.

### References

1. Perez, J., A. Boehman, Penn State Multi-Discipline Tribology Group and Energy Institute Studies The Pennsylvania State University, University Park, PA (1998).
2. Jones, E.G., W. Balster, W. Rubey, Fouling of Stainless Steel and SilcoSteel Surfaces During Aviation-Fuel Autoxidation Systems Research Laboratories, Inc, Dayton, OH; University of Dayton Research Institute, Dayton, OH (1995).
3. Altin, O., S. Eser, Analysis of Solid Deposits from Thermal Stressing of a JP-8 Fuel on Different Surfaces in a Flow Reactor Ind. Chem. Res, 40: 596-603 (2001).



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## SilcoTek treatments are available worldwide!

**SilcoTek offers treatments on a custom basis direct from our facility. Just follow 2 easy steps to maximize the performance of your product!**

### Step 1 - Get a quote!

We make it easy with quote options to fit your needs visit our website at [www.SilcoTek.com](http://www.SilcoTek.com) and complete our on-line quote request form or fax your quote request to Quotes at 814.353.1778 or e-mail it to [Silcod@SilcoTek.com](mailto:Silcod@SilcoTek.com). We'll get a quote out to you within 24 hours!

### Step 2 - Send in your parts!

Mailing instructions, shipping labels and a service number will be forwarded to you along with your quotation. Box up your parts and send them to us. Your order will be processed in 10 working days or less.

Our 2 touch system means zero disappointments. We'll notify you when we receive your parts and when your order is ready to ship.



**SilcoTek treatments are available worldwide through representatives in analytical instrumentation, tubing specialists, fitting manufacturers, and other technology industries. For a complete listing of where you can purchase SilcoTek treated products, go to our website [www.SilcoTek.com](http://www.SilcoTek.com)**