

Protecting Furnace Components with

Minimox[®] Alloy Treatment

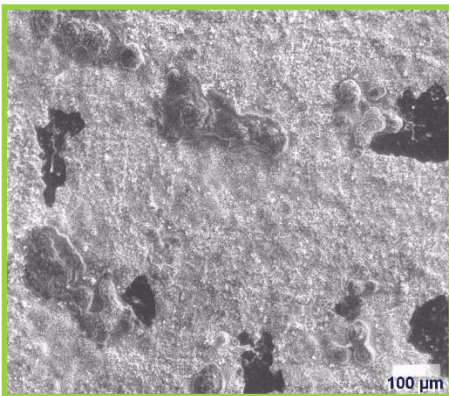
Material Interface, Inc.

Minimox[®] Self-Protective Alloy Treatment is a new, patented product that minimizes oxidation of alloys at high temperatures. Corrosion resistance is often improved as well.

When applied before oxidation, Minimox[®] treatment changes the structure and/or chemistry of the subsequent thermal oxide. The new thermal oxide is more dense and adherent than the oxide would be without Minimox solution. Corrosion resistance is also provided.

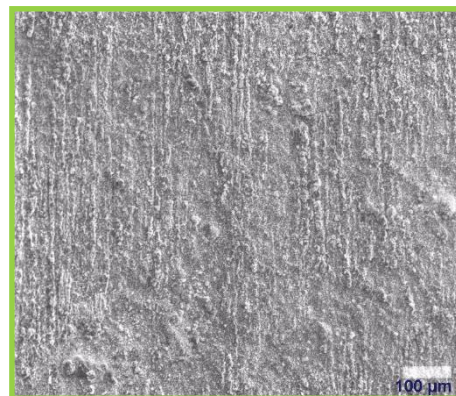
The dense thermal oxide protects the sample.

Ni 600 Thermal Oxide, 1000°C, 500 Hr



Thermal oxide without Minimox coating:

- Flakes
- Protrusions
- Microvoids for corrosion nucleation



Thermal oxide with Minimox coating:

- Dense
- Adherent
- Smooth

Possible Heat Treat Furnace applications include:

- Thermocouple covers
- Belts
- Fans
- Radiant Tubes & Supports
- Baskets
- Curtains

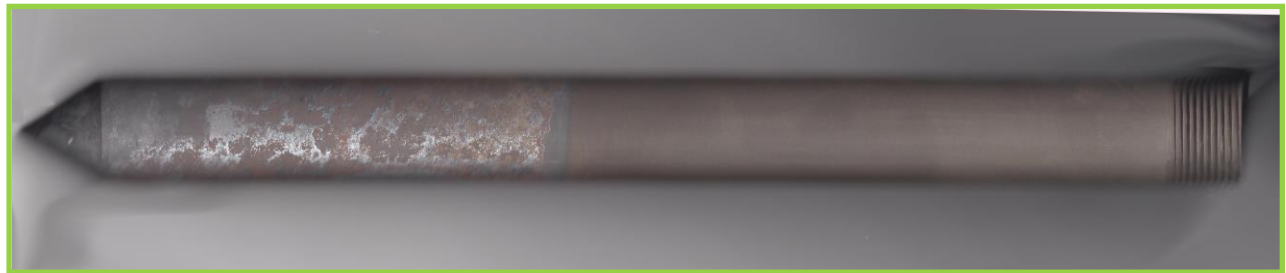
*Potentially improve
component lifetime for
pennies/square foot!*

Oxidation improvement

This is a straightforward application for Minimox® Self-Protective Alloy Treatment. The components need to be thoroughly cleaned and free of debris. Because blasting leaves embedded media, detergent and/or solvent washing is recommended. A machined finish works best.

Clean, spray or dip into Minimox® solution, air dry, and install. Depending upon the specific application, redipping or respraying may be necessary.

*304 Thermocouple protection tube;
815°C, 200 hours, air.*



Untreated, spalling

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Treated, stable oxide

Thin protective oxide on Minimox-coated surface. Spalling, unstable oxide on untreated portion.

Decrease carbon uptake

Laboratory tests have demonstrated:

1. Reduced carbon pick up in pack carburization experiments
2. Metal dusting reduction

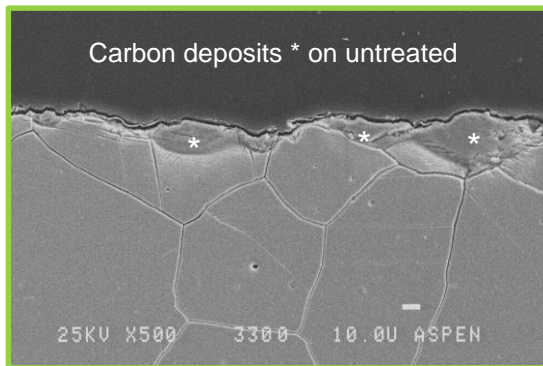
Keep in mind, the sample must be cleaned, coated with Minimox, and preoxidized. Our current recommendation is to preheat to 600°C for 10 hours in air.

The oxide protects the sample and reduces carbon uptake.

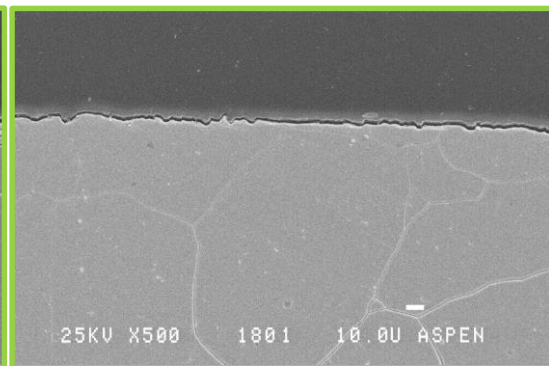
1. Pack Carburization

330 coupons; coated with Minimox, oxidized 600°C, 10 hours. Exposed to pack carburization at 593°C, 600 hours.

Untreated 330 showing carbon ingress on cross section

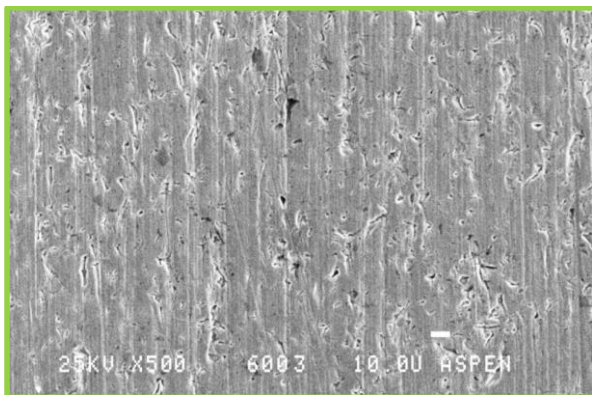


Treated 330 showing no degradation during graphite exposure.

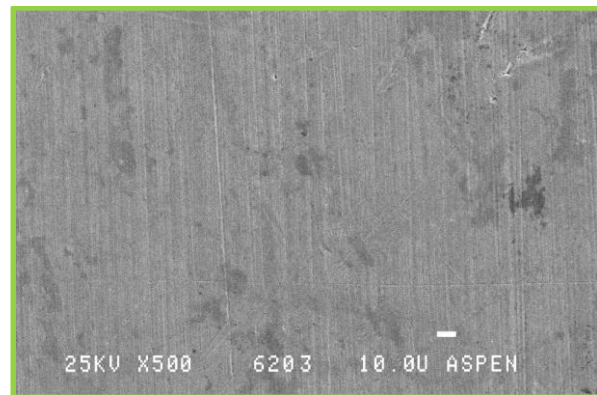


2. Metal Dusting Reduction

Testing at Argonne National Labs, Alloy 601, 600°C, 4286 hrs.



Untreated



*Minimox-treated and preoxidized
Substantially improved surface integrity*

How do I get started with Minimax?

Call or email our office to discuss your application.

If samples go into a high temperature, oxygen-containing environment, do they need preoxidation?

No. Clean, coat and put into service.

Do I have to preoxidize the sample to prevent carbon ingress or metal dusting?

Yes.

How long and at what temperature do I need to preoxidize?

This is different for all alloys and systems, but current testing for 330 stainless indicates 10 hours at 600°C is a good starting point.

How do I know how thick the oxide may be?

Material Interface, Inc. has been conducting metallurgical analysis for over 20 years. We will work with you to measure thickness and determine surface integrity if necessary.

Do I need to recoat periodically? How often?

For applications like furnace belts that may stretch over time, reapplication is recommended. Unfortunately, the most economical frequency is currently unknown. A reasonable time may be once/week.

Can the efficacy of Minimax be guaranteed?

Not at this time. Minimax is a new product and is transitioning from laboratory tests to field use. Production quantities are ready for delivery.

Material Interface, Inc.

About Us

Material Interface, Inc. is a contract laboratory that specializes in failure analysis and product R&D using surface analysis techniques, coating design, and consulting. We are dedicated to the development of superior products through improved surfaces, interfaces, and coatings.

Founded in 1993, Material Interface offers state-of-the art materials analysis with personalized service, including full reports with all projects.

The development of Minimax® Self-Protective Alloy Treatment grew out of years of stainless steel surface analysis. The patent was received in 2012.

Contact Us

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Turbine blades

Samples on left are untreated; those on the right were dipped in Minimax Self-Protective Alloy Treatment before heat treating.

