

BLACK OXIDE: Good Looking Rust!

Black oxide, also known as "gun bluing," is one of the lowest tech coatings Anoplate applies, yet it is also one of the most popular. In fact, Anoplate has invested in a new black oxide line to help meet the demand. The basic process, high temperature alkaline oxidation, has been around for nearly 70 years. It produces an attractive black finish that is very economical. The term black oxide refers to the oxidation of steel, stainless steel and other ferrous alloys. While copper alloys and aluminum can also be oxidized to achieve a black color, this article is limited to black oxides on steel and stainless steel.

TYPICAL USES

The biggest reason to use a black oxide coating is to reduce light glare. For example, on moving tools and machine parts, safety is

improved and eye fatigue reduced by using black oxide. Certainly, this is the reason nearly every gun manufacturer uses it and why many optical systems specify black oxide by name.

While the coating by itself has limited corrosion resistance on steel parts, its ability to absorb sealants or rust-inhibiting preservatives makes black oxide an ideal, economical choice for a corrosion-resistant coating. Keep in mind however, that the protective value of black oxide is good only as long as the preservative is present. Consider: there's a good reason why the hunter oils his rifle down after each time it is used in the moist outdoors.

The appealing look of black oxide also makes it desirable for wood stoves, tableware, model trains, fire poker, and hand tools. Since the process results in no dimensional change, it is ideal for protecting gauges, gears, cams, and

threaded precision components where other coatings would result in an unacceptable buildup.

Continued on page 2

■ **New black oxide line offers improved delivery, more consistent quality and better value. Both rack & barrel processing available.**



INTEGRATED ENVIRONMENTAL MANAGEMENT SYSTEM AND NEW POLICY BASED ON ISO 14001 COMPLIANCE

To formalize its environmental programs into a single integrated system, Anoplate is implementing the ISO 14001 Environmental Management System (EMS). The Executive Committee expects Anoplate to be certified to the ISO 14001 Standard by late summer of this year. The company's comprehensive Environmental Policy, included in this issue, is to be the cornerstone of the EMS, establishing the guiding principles for all company activities. From this Policy will flow objectives, targets, programs, projects, and metrics to demonstrate the continuous improvement of the company's environmental performance.

Anoplate continues to invest in capital and procedural improvements to implement new technologies and processes. Examples are: nickel-free black oxide; regenerative electro-less nickel; less toxic metal substitute chemistries; mechanical and process control upgrades; a state-of-the-art solvent vapor degreaser; and waste

Continued on page 3

BLACK OXIDE

continued...

PROCESS

When steel oxidizes at room temperature, moisture from the air reacts with the iron to form the all-too-familiar reddish-orange iron oxide known as rust. To the chemist or metallurgist, this common form of iron oxide is ferric oxide, chemical symbol Fe_2O_3 . On the other hand, chemical oxidation of steel converts a superficial iron layer into the most stable ferrous-ferric oxide, Fe_3O_4 , also called magnetite. A version of what platers perform is reacting iron with superheated steam at temperatures above 300°C (572°F). This reaction occurs at lower temperatures, about 150°C (290°F), in alkaline baths by adding oxidizing agents, such as sodium nitrite or sodium nitrate. The reaction mechanism for this coating remains largely unexplained. Because the reaction is chemical in nature and requires no electricity, parts can be done in bulk using baskets or barrels. Many parts can be done at one time resulting in the most economical finish available.

As in any finishing process, parts must be clean of scale for the coating to form. Anything such as oil, heat treatment or weld scale, dirt or rust can create a barrier between the iron in the surface and the oxidizing solution, inhibiting coating formation. These must be removed chemically using alkaline cleaning, blasting, acid pickling or a combination of these prior to the black oxide process.

Generally, black oxide coatings on stainless steels are formed at slightly lower bath temperatures. The unique thing about stainless steel blackening, besides the fact that it requires a separate bath with different oxidizers, is the that they must be activated using warm or hot acid prior to blackening. Hot sulfuric acid is used to activate Type 300 stainless, while concentrated hydrochloric acid is used to activate 400-series stainless. Black oxide on stainless is clearly a lost art and is a significant struggle for even the regular practitioner.

PROPERTIES

APPEARANCE:

Bath temperature, alkali concentration, and pretreatment largely affect the uniformity of appearance and color produced during black oxide. It is not uncommon for high-strength or hardened steels to have a brown or reddish undertone, due to the limited oxide

layer that forms on these types of steel. Abrasive cleaning, such as glass bead blasting or acid pickling, assists in uniformity and getting a deeper black appearance. However, these pretreatments are not always possible due to economics, surface finish, metallurgical, or other considerations. Since the bath is so concentrated with salts, it is very common for the oxidizing salts to be retained in pits, in blind holes, behind welded components, or in any crevice or crack formed. These are avoidable can be removed with diligent care using directed water sprays or ultrasonic rinsing.

THICKNESS:

There is no noticeable dimensional change with black oxide coatings. At most, they are typically on the order of 10-20 millionths of an inch thick. The only time Anoplate ever ran into difficulty with this was with aircraft bearing rollers ground to within 50 millionths of an inch with an 8 RMS finish. Upon initial



■ **Black oxide provides life long lubricity/protection in many aerospace applications**

examination, a certain operator didn't like their appearance. He took it upon himself to rework them. That week, everyone took home a scrap black oxide roller along with a paycheck. That was nearly 20 years ago and those employees who were there still talk about that several thousand dollar blunder!

ADHESION:

Black oxide is a true conversion coating, where iron in the steel oxidizes directly to form the coating. Unlike plating, there is a direct chemical and metallurgical bond between the coating and the substrate. Therefore, black oxide coatings do not peel or separate from the basis metal. A word of caution, however: these coatings are not very abrasion-resistant and since they are thin, they can easily be abraded away. This lack of abrasion resistance is sometimes confused with poor adhesion. Another characteristic of these coatings on stainless steel is that they are often powdery and rubbing them removes some

black smut. This is to be expected. Unless repeatedly wiped, it should not expose the basis material. (If black on stainless is easily wiped off, there is clearly a processing problem which can be avoided.)

CORROSION RESISTANCE:

Black oxide coatings on steel with no additional protection have low corrosion resistance. For this reason, parts are additionally coated with oils or waxes. In this way, salt spray resistance can be increased from only a few hours to over 100 hours. If a customer wants black oxide with no preservative, Anoplate provides it as long as (1) the customer specifically requests it and (2) the customer is informed that Anoplate is not responsible if the parts rust after they have been shipped.

EMBRITTLEMENT:

While various references state that there is little or no potential for hydrogen embrittlement of high-strength steel, a phenomenon known as caustic embrittlement can occur on certain high-strength materials under particular applications. When subjected to high or cyclical loading, caustic embrittled parts can initiate cracks that can result in catastrophic failure. While Anoplate has never encountered this directly and other aerospace manufacturers continue using it, this is what led to Sikorsky eliminating the use of black oxide on their airships.

WHY ANOPLATE FOR YOUR BLACK OXIDE?

Anoplate has been doing black oxide since its first day of business in 1960. That's a 40-year record of not only success but also advances in pretreatment which have resulted in a richer, more uniform black. Anoplate offers specific activation cycles for various types of stainless alloys that result in superior adhesion, abrasion resistance and appearance. Some demanding customers have pushed the design limits of black oxide for improved lubricity and corrosion resistance, for example. Anoplate has researched and made available various sealants, dry film lubricants, and preservatives which further push the capabilities of black oxide. Finally, Anoplate's new black oxide line is an investment in continuing to serve customers' black oxide needs for many years to come.

ENVIRONMENTAL POLICY *continued...*

management practices. All are aimed at improving the company's overall environmental performance. Anoplate is widely recognized for environmental stewardship. Its outreach to federal, state and local regulatory agencies and other stakeholders is as an industrial partner and information resource in the development of new regulations and initiatives. Anoplate participates in technical conferences, committees, training seminars, and publishes technical articles in trade literature.

For environmental policy questions, please contact:

Michael Florczykowski
315-471-6143, ext-134
or by e-mail at:
mflorczykowski@anoplate.com



■ **Managing Systems and Monitoring Processes are critical components of Anoplate's comprehensive Environmental Management System.**

ANOPLATE ENVIRONMENTAL POLICY

Anoplate Corporation is committed to conducting its operations in a manner that meets or exceeds applicable environmental laws and regulations and other voluntary commitments to which the Company may subscribe. Anoplate will seek methods to prevent pollution at the source, re-use materials within our own processes, and recycle materials off-site as much as possible in order to conserve valuable natural resources and raw materials, minimize the generation of wastes and the impact of Company operations on the environment.

The Company will maintain an on-going and systematic review process to identify environmental impacts, establish and carry out control programs and projects, and continuously improve environmental stewardship.

Anoplate will improve its manufacturing and control systems to more efficiently produce goods and services that satisfy our customers' requirements. Anoplate will develop, document and communicate the general principles and practices of this Policy to all employees and train each employee in the specific practices related to his or her job that will promote the protection of human health and the environment.

We will strive to be a good corporate neighbor to other environmental stakeholders through involvement with training and education outreach programs as an information resource and other related activities for the public good. Anoplate will strive to manage its operations in a manner that implements these principles to continuously improve environmental results.

Executive Committee

Milton F. Stevenson, Jr. James D. Stevenson
John A. Stevenson Michael H. Kauffman

Chief Environmental Officer

Michael E. Florczykowski

March 2000

■ **The air we breathe is as precious as the water we drink.**



Anoplate People

"Good Morning, this is Customer Service. How may we help you?"

Whether stated exactly this way or not, this friendly greeting is what you should hear when calling Anoplate's Customer Service Department. To better serve the needs of customers, Anoplate has reorganized the Production Control Department into a customer service work center. The goal is to meet customer-requested order dates 100% of the time. For example, if Anoplate is unable to meet your date, a Customer Service representative will notify you and work with you to reschedule a mutually agreeable date.

Need to expedite an order? Customer Service representatives Dale Fauvelle and Jen Benedict are here to help. When requesting status or expediting jobs, they suggest that you have purchase order and part numbers available so that they can quickly track the order. It is also important for you to supply a "real" completion date, since "ASAP" can mean different things to different people, and Anoplate's version of "ASAP" may vary from yours. The goal is simple: to get you what you need, when you need it.



The Anoplate Customer Service Team

Dale Fauvelle
Senior Customer Service Rep

Dale joined Anoplate in 1991. His previous experience in customer service, expediting, shipping and receiving at Carrier and LCP gives Dale the knowledge to help serve customers. When he is not at work, Dale keeps busy with his wife and three children. His recreational interests include hunting, camping and boating.

Jen Benedict
Customer Service Rep

Jen is new to the Customer Service Team, starting in November, 1999. She has been a temporary employee in the Receiving Department, an experience that allowed her to learn the Anoplate computer system as well as get to know many customers. When the opening became available in Customer Service, Jen took a series of customer service tests. She was selected based on her test results, and her previous experience in customer service at Walmart. She has the skills Anoplate needs to insure fast and friendly customer service. When Jen is not on the job, she enjoys spending time with her daughter.



Scott MacKinder
**Production Control/
Customer Service Manager**

Scott is a 20-year Anoplate veteran. Since Customer Service and Production Control need to work together, Scott manages both functions. He works closely with the production departments to schedule jobs and meet the needs of customers. He also works with Dale and Jen to ensure that the jobs they are expediting are properly



scheduled. Scott no longer takes the daily customer service phone calls himself, so he can spend more time coordinating customer production requirements. Scott is married, the father of three children. In his spare time, he likes hunting, bowling and boating.

GOT E-MAIL?

For fast response and to save customers time and money, Anoplate's Customer Service Department has an e-mail address:
cust_service@anoplate.com

GIVE IT TRY!

ANOPLATE

Anoplate News

Spring 2000

A publication of
Anoplate Corporation
459 Pulaski Street
Syracuse, New York 13204-1134
Phone: (315) 471.6143
Office Fax: (315) 471.7132
Quote Fax: (315) 471.4206
www.anoplate.com
An equal opportunity employer

For a free subscription to *Anoplate News*, please submit your request on company stationery.

Established 1960