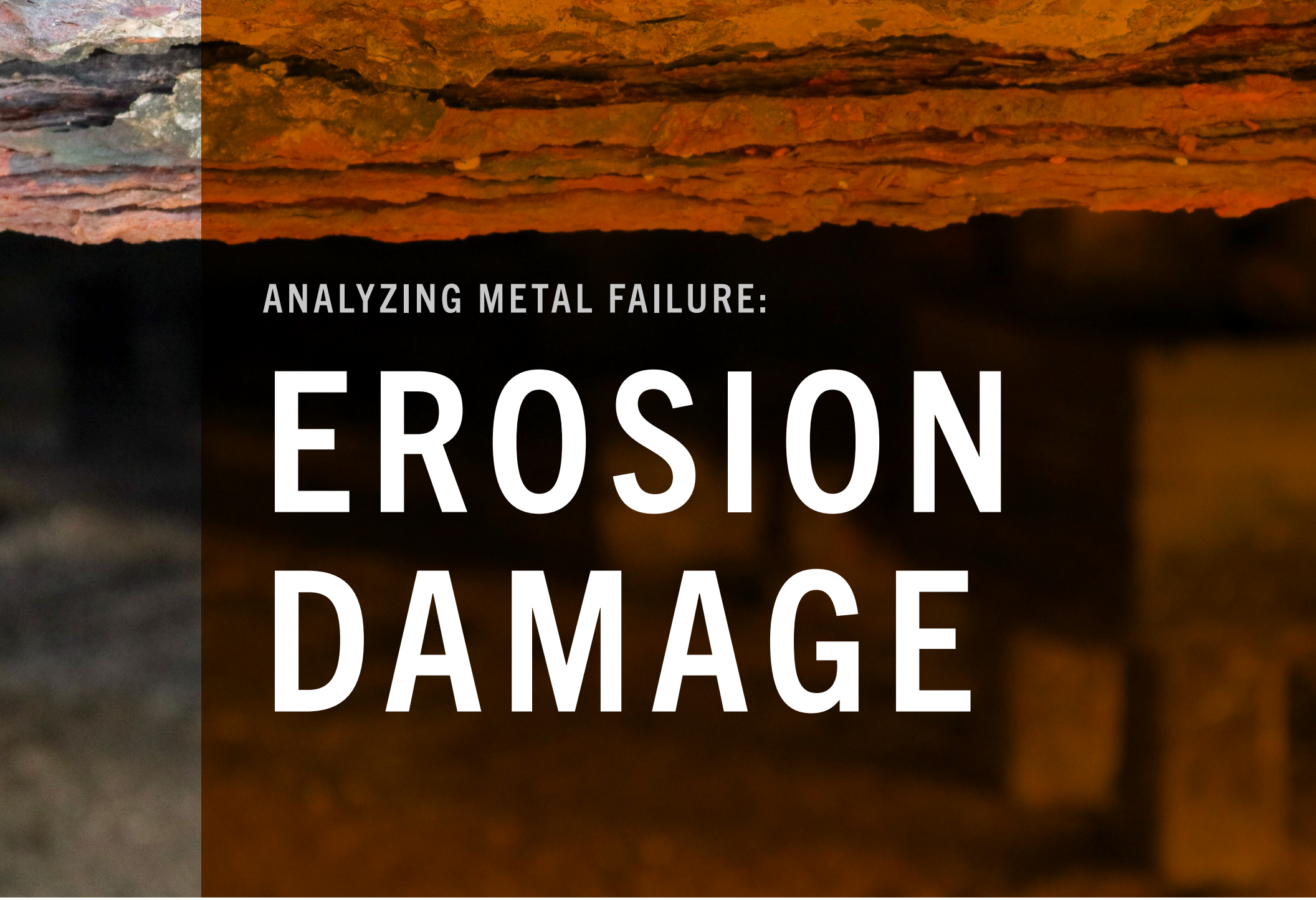


ANALYZING METAL FAILURE:

EROSION DAMAGE

ARMOLOY
ARMOLOY OF ILLINOIS

TABLE OF CONTENTS

METAL PARTS AND DEVICES: STRONG BUT NOT INDESTRUCTIBLE

As strong as the different types of metal are, there are forces that can slowly (or rapidly, in some cases) start to degrade them. If those forces are not checked, a metal item ultimately can fail. And depending on how and where that item is used, the consequences can be anywhere from a minor annoyance to a major problem.

The “big four” forces that can have a negative impact on the structural integrity of metal are:

CORROSION

Corrosion changes a refined metal, making it more chemically unstable. It tends to be a rapid process when exposed to corrosive chemicals. For example, when metal is exposed to a corrosive chemical and converted to sulfide or oxide.

ABRASION

Repeated mechanical actions like scuffing or scratching can remove material from a metal surface, such as when two metal parts rub together.

CONTACT FATIGUE

Contact fatigue is the development of small cracks in metal (or any material) as a result of it being exposed to weight or pressure repeatedly over a period of time.

EROSION

Liquids, gases, or other particles in motion can remove material from a metal part, tool, or device. Cavitation can have this effect, as well.

While these all are natural forces, there are steps that product designers, engineers, manufacturers, purchasers, and others can take to prevent or minimize their effects. Taking these actions can:

- Keep an item from wearing out and failing faster than it should
- Ensure that the item functions with maximum effectiveness

This guide is the third in a series of four on how advanced coatings can prevent metal failure. In particular, the information below addresses the effects of erosion and the benefits that can be obtained from having an advanced coating applied to an item.

EROSION'S COSTLY COLLISIONS

When fast-moving gases or liquids strike a metal surface, those collisions eventually take a toll on the surface. This occurs at a microscopic level, but a good macroscopic visual representation is shorelines that are subjected to the pounding of heavy surf.

Over time, the waves eat away at the sand or rock, pulling more and more of it into the water and away from the coast. In some cases, the result of unchecked erosion is a shocking image everyone has seen in the news: a cliffside home or other structure collapsing into the waves.

Away from the seashore, where is erosion a force to contend with? The businesses most affected by metal erosion are those where the rapid movement of material—fluids in particular—is essential to success. The oil & gas industry, water treatment facilities, and food processing systems are just a few examples.

These types of businesses need to pay special attention to places where moving fluids or gases change directions. There is significantly more erosion in the bends and curves of a pipe than in straight pipe

sections. And, of course, the characteristics of the materials striking a metal surface play a key role in the rate and amount of erosion from that surface.

How does metal erosion and metal failure affect businesses? In many ways, including:

1. HIGHER ASSET REPLACEMENT COSTS

The more quickly erosion and other forces cause a part, tool, or device to fail, the more quickly it has to be repaired or replaced.

2. INCREASED DOWNTIME

Productivity and profitability plummet when an assembly line stops or employees have to pause their work because of metal failure.

3. QUALITY ISSUES

Even before a metal item fails due to erosion, the change in its shape and dimensions can affect its functionality, leading to poor-quality output.

4. UNHAPPY CUSTOMERS

When downtime jeopardizes deadlines or the quality of manufactured items drops, customer satisfaction drops, as well. Plus, unhappy customers tend not to provide referrals.

5. SAFETY

Drips, leaks, and ruptures create hazardous conditions for employees and customers. Many of these conditions can be eliminated with the application of a chrome coating.

SHIELDING METAL FROM EROSION DAMAGE

When it comes to protecting a strong material like stainless steel, what is needed is something even stronger. Chromium meets that description. It is one of the hardest metals discovered and can be applied in incredibly thin layers that provide more protection than another material might at 10 times the thickness.

A chromium coating will act as a protective surface barrier to prevent abrasive slurries and corrosive materials from making direct contact with metal parts, tools, and devices.

Armoloy's advanced chromium coatings come in different formulations for different purposes:

THIN DENSE CHROME (TDC)

This coating is ideal when high precision and tight tolerances are required for an item.

DIAMOND CHROME

Referred to as XADC, this material can be applied to nearly every common type of manufacturing steel.

NICKEL TEFLON

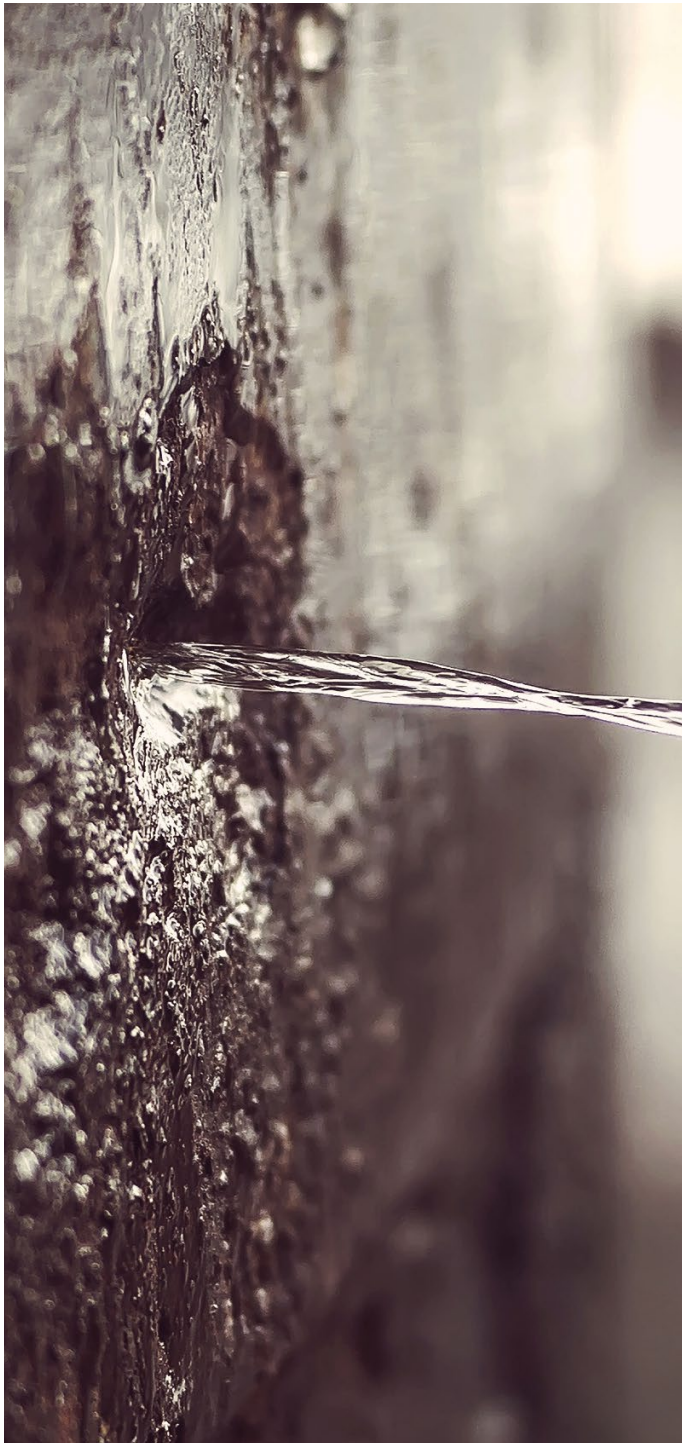
Armoloy calls this coating "nyflon." It is a co-deposit of electroless nickel and PTFE (Teflon©) that can be used with all common steels, including stainless steel, aluminum, brass, and copper.

ELECTROLESS NICKEL

This material provides uniform coverage, even in curves, holes, or recessed areas.

HYBRID COATINGS

Armoloy's Bi-Protect coating combines electroless nickel with an overlay of Armoloy TDC or XADC.



5 WAYS CHROMIUM COATINGS IMPROVE BUSINESS RESULTS

It makes sense that preventing substances from striking a metal surface protects that surface. But how does that protection then benefit the business?

FIVE PRIMARY ADVANTAGES COMPANIES ENJOY WHEN THEY COAT IMPORTANT METAL ASSETS:

1. Longer lifespan

Properly protected items last longer, which reduces maintenance and replacement expenses.

2. Protection with no change in specs

A thin layer of chromium protects an item without affecting how it functions or interacts with other items.

3. Increased uptime

Preventing metal failure also prevents all of the consequences of metal failure, like idle manufacturing processes and workers.

4. Improved functionality

Without protection, a metal item can begin eroding immediately, which means its performance begins degrading immediately. Coated items keep working as designed longer.

5. Increased customer satisfaction

When a company hits its delivery deadlines and fills orders with flawlessly coated parts, tools, and equipment, the result is strong business relationships, increased customer retention, and often, enthusiastic referrals.

BEING PROACTIVE ABOUT PROTECTION

Chromium coatings can help protect metal tools and devices at any stage of their lifecycle, including those that are already in use.

Armoloy regularly works with product designers to determine the ideal coating during the product development phase.

ARMOLOY
ARMOLOY OF ILLINOIS

PERFECTION IS OUR STANDARD

A licensee of the Armoloy Corporation, Armoloy of Illinois has been in operation in its original location since 1969 and is located 60 miles west of Chicago, in DeKalb, Illinois.

Providing a full range of surface coatings, from Thin Dense Chrome to Nickel-Teflon, Armoloy of Illinois serves the greater manufacturing community in the United States, with a strong and growing international reputation.

With a fully staffed chemistry lab, Armoloy of Illinois functions as an innovation incubation center for Armoloy Corporate. It is often the first place customers in the nuclear power, aviation, food-manufacturing and other sectors turn to for solutions to “impossible” coatings challenges.

Armoloy of Illinois is ISO 9001:2015 certified