

Expanite's Environmentally Friendly Surface Hardening Replaces Hard Chrome Coatings

The REACH regulation was established by the European Union to better protect health and the environment from the dangers of chemicals. REACH, an acronym for Registration, Evaluation, and Authorization of Chemicals, defines how and under which conditions specific chemicals can be used within the EU.

REACH regulation

Although this regulation came into effect in 2007, it gained more attention in 2013 when Chromium Trioxide (Chromium(VI) oxide) was added to the list of substances requiring authorization because of its carcinogenic and mutagenic properties.

Chromium(VI) oxide stands out from other substances on this list because of its wide range of applications. It is primarily used for surface treatments, whether for enhanced corrosion protection or the production of visually attractive surfaces. As a result, many industries, such as the electroplating industry and mechanical engineering, are feeling the impact of this regulation.

Coating

In general, coating methods that can prevent corrosion tend to add material and are often inconsistent in terms of the thickness of the applied layer. This can result in material accumulations on flat structures or material thinning at corners and edges where protection is reduced. Additionally, coatings may crack and peel off during significant expansion or contraction of the base material due to differences in the thermal expansion coefficient between the base and the coating. Complex contours with undercuts and small openings pose additional challenges, and certain coating methods are not compatible with these surfaces. Expanite takes a different approach to this process that avoids these issues.

The sustainable Expanite® processes:

A solution to the above-mentioned problems involving stainless steels is surface hardening. This is not a coating process but a diffusion-based surface hardening process. Traditional methods for surface hardening corrosion-resistant stainless steels have been available to the industry for some time. However, they mainly have two disadvantages: they reduce corrosion resistance, and the hardness value of steels hardened with nitrogen or carbon often decreases rapidly at the material core. This means that the hardening depth is only a few microns, and the underlying structure is very soft, which can potentially lead to an "eggshell effect."

Expanite has developed a method that hardens not only the outermost layer, but also hardens the underlying material to a greater depth. In many cases, this also results in improved corrosion resistance.

The Expanite treatment for stainless steels involves a two-step process. In the first step (high-temperature process), nitrogen is introduced deep into the surface zone, allowing the material to achieve a hardening up to 1mm in depth ranging from approximately 300 HV (austenitic materials) to 850 HV (martensitic materials). In the second step, the so-called low-temperature process, the workpiece is heated to a maximum of 470°C, and the surface layer is hardened to a depth of 5-30µm, achieving 1100-1300HV (see photo 1), through the embedding of carbon and nitrogen.





Combining these two processes prevents the aforementioned "eggshell effect" and offers significant advantages for different kinds of applications.

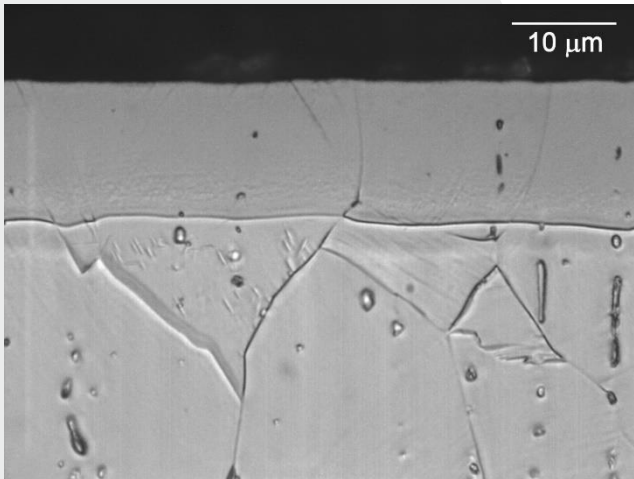


Photo 1: Expanded Austenite after the Process

Eco-Friendly

Despite its widespread use, hard chrome plating has several disadvantages. Harmful chemicals such as chromic acid, sulfuric acid, lead, lead chromate, and lead oxide are all used in the process. Additionally, it is largely inefficient with at least 70% of the electrical energy being wasted.

SuperExpanite®, the trade name for the layer produced in the Expanite's two-stage process, stands out for its resource-saving approach. It neither consumes natural re-sources nor produces polluted wastewater. With a low energy consumption of only 1.9 kWh/kg of hardened stainless steel and without the use of harmful chemicals, it offers an environmentally friendly and sustainable alternative to hard chrome plating, which also extends the lifespan of fittings.



Photo 2: Furnaces for surface hardening stainless steel products



Ideal for Abrasive Media Due to Increased Hardness

Hard chrome coatings typically have a hardness of HV 300-1,400, whereas SuperExpanite achieves HV* 1,200±100. The increased hardness of materials treated with SuperExpanite therefore provides better wear resistance, making them perfect for applications involving abrasive materials.

Better Resistance to Galling

Both the SuperExpanite treatment and hard chrome plating produce a strong resistance to galling. However, the inherent cracks in hard chrome coatings can cause the tarnishing of the partner surface, which can lead to galling. By contrast, surfaces hardened with SuperExpanite are crack-free and resist galling.

A Broader Range of Applications Due to Improved Corrosion Resistance

The SuperExpanite treatment does not adversely affect the corrosion resistance of the base material; it can even enhance the corrosion resistance of certain materials, such as stainless steel 316L. Conversely, hard chrome plating produces a layer on the base material that may be incompatible with certain substances due to corrosion. For instance, sulfuric acid and phosphoric acid are not compatible with hard chrome coatings. However, stainless steel 316L or 254SMO, which many valve manufacturers supply as the standard, that is treated with SuperExpanite can be used with these substances depending on the concentration and temperature. This means that the SuperExpanite treatment can be utilized in situations where the use of hard chrome is prohibited or technically impracticable.

Extended Lifespan in Abrasive Applications

The SuperExpanite treatment can be used on components that are not traditionally hard-chromed, such as valve housings. The increased hardness of the SuperExpanite process results in a longer lifespan when valves are used in highly abrasive applications.

Summary

With its technology hardened surface layers, Expanite offers a more environmentally friendly alternative to hard chrome that boasts a lower energy consumption, higher hardness, and better resistance. Expanite also provides a longer lifespan in abrasive applications and a more robust surface treatment without the typical risks of hard chrome plating.

About Expanite:

Expanite is a Danish company specializing in heat treatment and surface hardening of stainless steel and titanium. Expanite has established itself as a pioneer and trusted partner in the industry. The sustainable and patented surface hardening processes improves galling, wear and corrosion resistance on stainless steel and titanium parts in a wide range of applications and industries.

The company has its head office in Hillerød near Copenhagen and service centers and licensees in the USA, Germany, Korea, and China. Expanite's DNA is based on sustainable solutions to extend the life of components made of stainless steel, titanium, and other high-value alloys - and the business model allows for license agreements whereby customers may implement the technology in their production lines. www.expanite.com

