EMPERION: The Fast, Efficient Way to Apply Duralar’s Advanced Hard Coatings Inside and Out
Unprecedented hard coating speed

Nothing compares with the Emperion’s hard coating speed. With deposition rates upwards of 0.6µm per minute it is many times faster than competitive systems, which can take hours off of previous processing times. This unprecedented speed is the result of a patented Duralar® deposition technology called DualArmor™ which immerses parts in an extremely high density ion plasma.

This means that if a user needs or wants thicker coatings, the Emperion can deposit them — quickly and economically. In the past, this was often not practical or even possible.

The Emperion’s system design also enables speed and high throughput. It features twin deposition chambers that allow continuous operation and production. While one chamber is processing, the operator can be unloading and reloading the second chamber.

Exceptional coating hardness

The leading-edge Duralar coatings deposited by the Emperion can be from 1000 Vickers to more than 2000 Vickers in hardness — as compared with high carbon steel which is typically less than 400 Vickers! And the specific hardness and toughness of a Duralar coating can be fine-tuned by adjusting the formulation of its component layers.

These coatings also have greater thermal stability than many other coatings. So they do not degrade and are able to maintain their performance even at sustained high temperatures.

DualArmor can coat inside and outside with excellent uniformity

The Emperion’s DualArmor process employs a unique “hollow cathode” chamber that can coat all surfaces of the parts completely and evenly, inside and out. Some coating processes such as hard chrome and thermal sprays are directional, so their coverage tends to be thicker on corners and edges and thinner on recessed areas. But because of the Emperion’s total-immersion process its coatings do not have “line-of-sight” limitations and are inherently very conformal. They cover three-dimensional features very consistently, even complex geometries such as screw threads. So they can maintain very precise dimensional tolerances without need for post-processing — which saves expense and streamlines your processes.
ArmorLube: a special new dry-lube hard coating, exclusively from Duralar

Duralar has introduced a unique new coating called ArmorLube, which combines exceptional hardness with dry lubrication. The coating’s high carbon content gives it a natural lubricity and a very low coefficient of friction — less than 0.1!

ArmorLube can dramatically enhance the performance of parts in firearms, for example, enabling smoother, more efficient operation while eliminating the need for oils and greases that can cause fouling problems. In many applications such as engine parts it can significantly improve power and performance while extending service life — reducing failure rates and minimizing maintenance downtime.

Superior corrosion resistance

Duralar’s leading-edge coatings provide several effective mechanisms for blocking corrosion: First, the coatings are inert and do not react with corrosive chemistries. Second, the coatings have no porosity or pinholes, thus no entry points for chemical attacks. Third, Duralar coatings are built from multiple layers, providing multiple barriers against the entry of oxidizing agents. The net result is exceptionally strong corrosion resistance.

Advanced coatings that are eco-friendly

Many coating processes pose serious threats to the environment and human health, and controls on them are being increasingly tightened. So today’s users are seeking more eco-friendly coating options.

Fortunately, Emperion coatings are completely non-toxic, inert and benign. These coating processes pose no human hazards and generate no waste products. Duralar’s advanced hard coatings are friendly to people and protective to the environment.

Unbeatable hard coating performance

The Emperion is a unique deposition system exclusively from Duralar Technologies. Its hard coatings provide unprecedented performance advantages while being faster and easier to apply. And without harming the environment.

All things considered, the Emperion is perhaps the most capable yet cost-efficient hard coating system in its class.
Proprietary DualArmor technology

The Emperion is a Plasma Enhanced Chemical Vapor Deposition (PECVD) system that employs Duralar’s unique “hollow cathode” technique. This creates a field of high-energy electrons moving pendulum-like between the sides of the chamber (the cathode), with the two ends of the chamber serving as anodes. This proprietary DualArmor™ process bathes the parts in an ultra-high intensity plasma — over 200 times greater than a standard plasma — that effectively and conformally covers all part geometries, both exterior and interior, and also allows parts to be coated at an unprecedented high rate.

During the process, high-energy ionized gases also clean the parts and create an optimized adhesive bond before the hard coating is deposited.

Importantly, the DualArmor process eliminates the line-of-sight limitations that spray-type coatings have. Since all deposition occurs within the dense plasma, all part surfaces — interior, exterior and complex 3D shapes such as screw threads — are coated with high uniformity, eliminating the need for post-processing.

The end result: significantly faster, higher-quality deposition and more complete, conformal coverage.

Designed for fast, efficient coating

A Duralar subsidiary originally developed ArmorLube technology in collaboration with the U.S. Army Armament Research, Development and Engineering Center to improve soldier weapon systems. The coating serves many applications, but the firearms industry is a particularly good example. ArmorLube can enhance the performance of hammers, trigger assemblies, bolts, bolt carriers, slides, levers, magazines and numerous other parts in handguns, shotguns and rifles, including semiautomatic and automatic models.

The Emperion system is designed for high throughput in volume-coating environments. The two standard Emperion deposition chambers are vertically oriented and are 40 inches in length by 10 inches in diameter. However, Duralar can also provide custom chamber configurations to fit the needs of a specific user.
A CHOICE OF DURALAR COATINGS TO ADDRESS SPECIFIC NEEDS

Duralar ArmorLube coating

ArmorLube is a very special Duralar coating that combines dry lubrication with exceptional hardness — up to 2000 Vickers or more. Plus, it is highly wear resistant. Created from a proprietary carbon-based formula, the carbon in ArmorLube provides a natural graphitic lubricity and an extremely low coefficient of friction — less than 0.1. This coating is well suited for applications that require a clean, dry, permanent lubrication, eliminating the need for oils or greases, which can accumulate dirt and cause fouling. In firearms, for example, ArmorLube is effectively used on dozens of different parts. This unique coating can dramatically reduce the problems of scaling, galling, fretting and many other friction-related issues, enhancing performance and lowering costs considerably.

Duralar Sliding WearGuard coating

The Duralar Sliding WearGuard coatings are created for use in applications that are subject to adhesive wear from the sliding motion of parts, such as in reciprocating pistons and pumps. These coatings have exceptional hardness and toughness and can be thinner, in the order of 3-6 µm in thickness, and still be extremely effective. Applications for Sliding WearGuard coatings can be found in oil and gas, automotive, aerospace and a broad spectrum of other industries. The coatings are able to serve very effectively even in challenging operating environments, both wet and dry, including oil and drilling mud.

Customizable coatings

Duralar coatings are unique in that they are comprised of multiple layers, which creates a more impervious barrier against corrosion and other attacks to the substrate. This layered construction also enables a coating’s performance to be tailored to specific applications by adjusting the composition and thickness of individual layers. For example, a coating may be made more or less hydrophobic, or tough, or hard, or wear-resistant, or brittle; or it may be modified in any number of ways to enhance performance for a particular application. You may see additional Duralar coating specifications in the chart on the back cover of this brochure.
Intelligently Designed for Fast, Streamlined, High-efficiency Processing

TWIN PROCESSING CHAMBERS TO MAXIMIZE YOUR THROUGHPUT

From the ground up, the Emperion was specifically designed to handle high throughput in volume-coating environments. From the twin-chamber design to the light-weight modular fixturing, every detail of the system was developed with speed, simplicity and process efficiency in mind.

The Emperion provides two separate chambers, left and right, so that while one chamber is processing, the operator can be unloading and reloading parts in the other. The result is maximized throughput.

Special fixtures enable faster, easier loading and unloading of parts

Some coating systems require the operator to load and unload parts using large carousels that are heavy and unwieldy. But the Emperion uses lightweight modular fixtures that an operator can handle far more easily.

And instead of one-size-fits-all, each Emperion fixture is custom designed for a specific part. Which makes it much quicker and easier for the operator to rack and unrack parts — and to load and unload them. Plus, the modular fixtures also simplify inventory management.

Quick-change shields minimize chamber-cleaning downtime

With many other deposition systems the chamber walls become coated and require periodic cleaning, which necessitates machine downtime. But the Emperion uses special lightweight modular chamber shields to prevent chamber wall coating, and these are quickly changed out after each run. The used shields are easily cleaned off-line — with no impact on throughput — and the freshly cleaned shields are subsequently reused.

Smart and powerful user interface

Operation of the Emperion is streamlined and simplified, as well. The system incorporates next-generation software, with an intuitive operator interface for advanced and powerful control of the machine and the process. Coating processes are automated through recipes and can also allow easy transfer from Duralar’s R&D center to customer sites around the world.
A very cost-efficient system

To begin with, the capital expense of an Emperion is substantially lower than many competitive deposition systems. Then, as one evaluates the full ROI, this equipment becomes even more attractive.

Elegant and compact, the Emperion has a footprint of 87 by 110 inches. And the system minimizes costs both in energy and materials. It is economical with electrical power and requires only a modest amount of chilled water and process gas. All of which makes it simpler to facilitate and easier to install. And smarter system design also enables the Emperion to deliver greater throughput with fewer operators.

Combining higher-quality, higher-rate deposition with fast-loading, twin-chamber processing efficiency, Emperion provides a level of hard coating performance that is unequaled in the industry.

Put your own Emperion to work!

Installing an Emperion coating system in your own production line can bring considerable savings in time and expense as well as significant enhancements to your end products.

You can streamline production cycles and eliminate the cost and delay of shipping to remote coating vendors. And you can gain the efficiencies of coating just-in-time if you wish, rather than in batches. Most importantly, you can get all the performance benefits of Duralar’s advanced coating technologies while maintaining complete control of your processes and the final product.

Speak with a Duralar engineer to get complete product details and to order an Emperion coating system that’s perfect for you.
Duralar Technologies is the global nanotechnology developer of Duralar state-of-the-art ultra-hard coatings. These next-generation eco-friendly products are designed to replace hard chrome, thermal spray and many other previous hard coatings for a spectrum of applications across a broad range of industries. The company develops, sells and supports a selection of leading-edge hard coating systems and also provides Duralar coating services.

Duralar U.S. Headquarters: 7620 N. Hartman Lane, #132, Tucson, AZ 85743 Tel: (520) 300-9972

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### Emperion Coatings - Specifications

<table>
<thead>
<tr>
<th></th>
<th>Duralar ArmorLube</th>
<th>Duralar Sliding WearGuard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thickness (µm)</td>
<td>7-15</td>
<td>3 - 6</td>
</tr>
<tr>
<td>Hardness (Vickers)</td>
<td>1000 - 2000+</td>
<td>1500 - 2000+</td>
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<tr>
<td>Wear Rate (mm³/nm)</td>
<td>5.0E-07 (dry)</td>
<td>5.0E-07 (dry)</td>
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<td>Coefficient of Friction</td>
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<td>&lt;0.1 (dry)</td>
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<tr>
<td>Deposition Rate</td>
<td>&gt;0.6µm / min</td>
<td>&gt;0.7µm / min</td>
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<tr>
<td>Deposition Temperature</td>
<td>150 - 250°C</td>
<td>150 - 250°C</td>
</tr>
</tbody>
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**Emperion Dimensions: 110"w x 87"d x 85.8"h**

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### About Duralar Technologies

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