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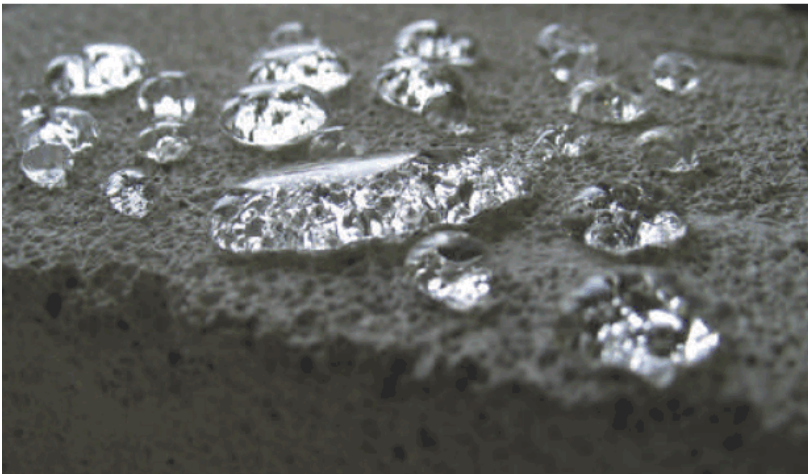
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Permanon: Nanotechnology-Based Surface Protection Reduces Factors that Cause Coating Failures

The highest quality, longest lasting coatings available to consumers are the finishes produced at the factory. Factory coatings are applied in a controlled environment, using quality materials and highly specialized application equipment. Also, the prefabricated metal will never be cleaner and in better condition than when it's used to manufacture new products.

treatment, and state-of-the art base coat/clear coat paint systems. The integrity of the original application allows responsible owners to provide a significant increase in service life through proactive maintenance.

Permanon¹ is a 21st Century nanocoating that has been developed to enhance the appearance and increase the durability of factory fin-



An illustration of the contact angle produced by Permanon on a masonry surface.

The longer the original factory coating lasts, the higher its value to the asset and the owner.

Finish quality is the primary attraction for new customers, but durability is also important. For this reason, many manufacturers go to great lengths to prevent the conditions that cause new coatings to fail prematurely. This involves critical surface preparation, rust inhibitive pre-

ishes and industrial coatings. Permanon is one of the first commercially available surface protectants to incorporate nanotechnology into its formulation. The main component of Permanon is Silicium Si-14, which is basically a highly compounded component of glass. When silicium is processed into nano-sized particles and incorporated into a water-based polymer solution, it is

transformed into a highly effective, ultra-thin coating for virtually any hard surface.

Permanon's unique properties are based on the science of nanotechnology—the creation, organization, or manipulation of materials, devices, or systems at the nanometer level. To understand nanotechnology, one must first become familiar with the ultra-small measurements involved. A meter is approximately 39 inches; a centimeter is one hundredth of a meter; a millimeter is one thousandth of a meter; and a micrometer is one millionth of a meter. By comparison, a nanometer is one billionth of a meter. Example: a red blood cell is 2,500 nanometers in size. A pin head, which is one millimeter in diameter, is equal to the surface area of one billion nanometers.

WHAT IT DOES

When Permanon is applied to a clean surface, that surface takes on properties that are virtually identical to hardened glass. It is chemically inert and will not react with the base material. In other words, dirt will not bond to the treated surface, thereby reducing soiling and organic staining. Acid rain and other chemical compounds easily wash off, significantly reducing the hydroscopic nature of surfaces exposed to industrial or environmental pollution.

Permanon features the following capabilities:

- **Dirt cannot bond to treated surfaces**
- **Surfaces are protected against industrial and environmental pollution**
- **Repels airborne dust**
- **Eliminates the need for harsh and potentially dangerous chemical cleaners**
- **Reduces cleaning costs by 50% or more**
- **Improves clarity of transparent materials and reduces light scattering**
- **Resistant to temperature**

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- extremes from 40°C to 300°C
- Resistant to ultra violet (UV) exposure, undiluted provides 100% UV protection
- Anti-fouling properties
- Significantly improves the "maintainability" of man-made surfaces

HOW IT WORKS

All materials are porous and contain microscopic peaks and valleys, much like the profile of a mountain range. These irregularities are known as capillary structures. On manufactured surfaces (including paints and coatings) there may be millions of these defects per square inch. Contaminants such as fine dirt, minerals, and pollutants are drawn into the voids where they are extremely hard to remove. Capillary structures also provide microbes and bacteria with an excellent place to grow and multiply.

The silicium particles of Permanon are laminar shaped, which means they overlap each other like the scales of a fish. These platelets are deposited on the capillary wall and closely follow the contour of its surface. These platelets will fill up to 90 percent of the capillary void, resulting in a surface that is smoother and more resistant to soiling. The overlapping of the platelets also reduces the permeability of the treated surface, making it virtually impossible for moisture and other reactive agents to migrate through the protected coating to the metal surface.

The Permanon application process essentially entails three steps: thoroughly clean the existing OEM coating, then wipe it down with a microfiber cloth (Superior Coatings recommends Extreme® by Simple Green.) Next, apply a solution of 5% vinegar and water, and just spray a light coat of that on, and then put the Permanon on the top of that. This will give it a little more attraction to the surface.

When Permanon is applied to a surface, it instantly forms an electrostatic bond with the base materi-

al. No reaction time is required, and rubbing, buffing, or polishing is not necessary. As soon as the silicium particles come in contact with the surface, the bonding process is complete.

I've been testing this for about 8 months; when you apply it to a clean surface, that surface virtually takes on properties of hardened glass. It's easy to clean, protects against UV light. What I like most about it is permeability control. When you spray it on a hard surface, it achieves a contact surface of 160 degrees and it virtually eliminates the transfer of moisture or other chemical compounds through the existing coating to the substrate.

Super water repellent. The filling of the capillary structures with silicium nanoparticles produces a hydrophobic surface. (A hydrophobic surface is one that repels moisture.) In contrast, a hydrophilic surface is one that absorbs moisture. The potential of a surface to absorb or repel moisture is based on many factors, including: temperature, relative humidity, material homogeneity, and static electricity. Surface roughness is also a major factor; the rougher the surface, the higher the spreading rate or attraction for water. The smoother the surface, the more repellent it is to moisture.

Contact angle measurement.

Permanon provides users with a simple way to determine the level of surface protection. The formation of large, closely spaced water droplets demonstrates that moisture is effectively prevented from being absorbed into the surface profile. The classification of water droplets on a hard surface is known in industry as a "water break test" or ASTM F-22. This test is used extensively in the industry to check surface cleanliness. The size, shape, and height of the water droplets are measured by their contact angle. Contact angle is figured by a straight line that starts at the base of the droplet and travels along its outer surface to the break-off point. The measurement between

this line and the surface determines the contact angle. Permanon can achieve a contact angle of 160 degrees on a clean hard surface. This indicates the surface is highly repellent to moisture and other liquids compounds.

Application. Permanon can be applied by spray, brush, wiping, sponge, or immersion. Since a functional coat of Permanon is only 100 nanometers thick (less than the diameter of a human hair). However, care must be taken to avoid over-application to prevent waste. For example, when Permanon is applied by atomized air spray, a .05 mm spray tip is recommend (normally, a size .12 mm or larger spray tip is used to apply coating). After application, wipe down with a microfiber cloth or rinse off the excessive with de-mineralized water to prevent water spots. To that end, Permanon is ideal for use in the transportation industry: planes, trains, and automobiles.

Economical. Permanon is very cost-effective. A surface free from grime, dust, and oil residue is all that is required before application. Since it is applied at only 100 nanometers thick, one liter has the potential to cover over one thousand square feet of surface area. Additionally, Permanon has the potential to cut down on your cleaning costs. In Europe they're getting an extra two years out of the life of their coatings when they apply the product.

One application of Permanon has the ability to last up to one year. Re-application has the potential to extend service life indefinitely. During reapplication the silicium particles will seek out damage point locations, rebound, and restore full performance capabilities. The electrostatic bonding of the silicium nano-particles is the only type of protective coating with the ability to reduced corrosion activity without the build up of excessive film thickness.

Self-repair capabilities. Permanon has the unique ability for self repair.

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Traditional products rely on multiple applications to maintain performance. This practice can trap dirt, grime, oils, or contaminants between layers and build up excessive film thickness over time. Trapped contaminants can also reduce the integrity of the original application and cause damage to the coated surface.

Corrosion Management. The service life of a protective coating is basically fixed at the time of application. This is based on coating selection, application quality, and the environment to which the coating will be subjected. Even though proven effective in the past, planned maintenance has limited use due to the complexity and high costs associated with the inspection and evaluation of aged coatings for repair. Another problem involves the fact that modern coatings aren't specifically designed for long-term maintenance support.

There is a definite economic necessity for planned maintenance programs. Experts expect future energy costs to at least double in the next 20 years. This could easily cause corrosion costs to exceed \$1 trillion dollars by 2050. The longer a protective coating lasts the higher its value to the asset and the owner.

CONCLUSION

For many applications, Permanon offers a simple, low-cost, environmentally safe way to extend coating life through a program of surface preservation and proactive maintenance. Virtually anyone can learn how to apply Permanon without any special training or equipment.

For many applications, Permanon can improve the effectiveness of maintenance operations by reducing or eliminating many of the factors that cause coatings to fail. This includes:

- Protection against moisture and chemical attack
- UV protection
- Ability to maintain impermeability for treated surfaces
- Reduced soiling and chemical attraction

When Permanon is incorporated in a well-planned maintenance program using specified coatings designed for long term maintenance support the following results are available:

- Increased service life for equipment and infrastructure
- A significant reduction in corrosion repairs, downtime and replacement coats.
- Improved performance and operational readiness
- Improved worker safety and morale
- Reduced waste and disposal costs
- Reduced VOCs, HAPs, and other types of greenhouse gases
- Improved remanufacturing and recycling potential
- Lean engineering, a reduced need to over-design

- products to resist corrosion
- Significant energy and raw material savings by improved coating performance
- Improved trade balance. U.S. products that last longer reduce foreign imports

BIO


Jim Deardorff is president of Superior Coatings Company, based in Chillicothe, Mo. He has more than 25 years experience in the application and maintenance of protective coatings for a variety of jobs, including equipment, metal buildings, storage tanks, and fabricated steel products. In recent years, a major part of Deardorff's work has involved classic car restoration, as well as tractors and vintage aircraft. Deardorff has also written more than 50 articles and is currently working with the Iowa Waste Reduction Center IWRC on an abrasive blasting training manual for the Department of Defense. The completed manual will include instructions on low pressure/low impact abrasive cleaning operations. Deardorff may be reached via e-mail at jdeardorffsupct@yahoo.com.

REFERENCES

1. CW Hayden, Auburn, Maine, has the exclusive distribution rights for Permanon in the U.S., Canada, and the Bahamas. For more information, please contact John Hayden at (877) 294-1849 or jhayden@cw-hayden.com.

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