

# Custom Coater Finds Simple Solution In Disposal-Free Pretreatment

**When Smart Manufacturing needed a simple, reliable and economical way to clean and treat a range of parts in different substrates, it found a solution in Plaforization. Read on to learn more about this disposal-free pretreatment process.**

**Rodger Talbert**  
*EDITORIAL DIRECTOR*

In 1994, Dale VanDyk saw a need for a specialty welding service that could deal with small parts that were hard for manufacturers to integrate into their own facility. He started Smart Manufacturing, a business built with the flexibility of a small job shop. It wasn't long before some of his customers asked him if he could also provide these parts with the coating already applied and ready for assembly or shipment. Two of his larger customers had products that needed to be powder coated and so he considered adding powder to his operation.

VanDyk considered his options and decided to set up a batch style powder coating system that could provide the same flexibility and quick turnaround of his welding operation. One of his two target customers came through and placed orders with him that required coating.

Smart Manufacturing, located in Schoolcraft, Mich., occupies 13,000 ft<sup>2</sup> in a larger building and currently employs seven people. They have applied powder coating on pump barrels for air pumps, components from electrical nursing home beds that they manufacture, tricycle components, landscape tools, four-wheeler frames, outdoor furniture parts, office furniture table legs and a variety of other products. Customers include contract metal fabricators that service the office furniture business and other companies that make products for the landscape, air pump and tricycle retail stores as

well as internet markets.

The system includes a cleaning station, a batch style powder booth, a powder spray system, and a cure oven. The largest part that they can process is 3' x 4' x 7' long.



***A small dip tank is used for Plaforization of parts at Smart Manufacturing, Schoolcraft, Mich.***

Smart applies mostly epoxy/polyester hybrids, urethane polyesters and TGIC polyesters from DuPont Powder Coatings and IVC. Each station has a cycle time of approximately 20 min. When the workload demands it they can use one person at each station. If the workload is light it is possible for one person to run the entire system.

One of the challenges that they had to deal with was a simple, reliable and economical way to clean and treat a range of



***The intake manifold was Plaforized and then powder coated blue.***



***This larger dip tank has an overhead hoist.***

parts in different substrates that included hot rolled steel (HRS), cold rolled steel (CRS), aluminum and even chrome plated parts. There is no city sewer available in our location so we needed a product that would not require any disposal, says VanDyk. Smart Manufacturing is ISO-9001:2000 certified, and it had to be sure to meet or exceed customer quality requirements.

The company considered the various chemical and mechanical cleaning methods available and found problems with most of them. Sand or grit blasting is often used to prepare parts prior to powder coating application. Smart rejected blasting because the equipment is expensive and some of the sheet metal parts that they needed to coat would not withstand the blast pressure. Also, blasting alone does not passivate the metal surface or add a conversion coating for corrosion resistance. Most dip and spray cleaning methods required mixing of chemicals, multiple stages of treatment and some discharge of the byproducts of the process.

While evaluating different ways to clean and treat parts, VanDyk read an article about a process

called Plaforization. The article detailed the process by explaining how a small job shop facing the same challenges as Smart Manufacturing selected this unique method for treatment that resolved a lot of the issues that made the other options less desirable.

Plaforization, a product supplied by Carpenter Chemicals of Alexandria, Va., provided a one-step cleaning and phosphating process that required no mixing, no special controls and no discharge of wastewater. The solution is a mixture of special fluids with a resin and phosphating chemicals that applies a thin coating of an inorganic phosphate made from the substrate metal (iron phosphate on steel, zinc phosphate on galvanized, for example), sealed by a polymer. It is applied at room temperature in a single step with no rinsing. It produces no liquid or solid waste, it does not require expensive equipment and it is simple to use. As material is consumed, it is replaced with fresh material. The contents of the tank remain effective by filtering out solids, so the tank does not need to be drained. One gallon of the material can treat approximately 1,200 to 1,600 ft<sup>2</sup> of metal.

When a part is exposed to the Plaforization chemistry through immersion or low-pressure spray, the oils and particulate on the surface are removed. Oils are taken into solution and solids are removed by circulating the solution through a filtering system. The metal surface is etched and phosphated in the solution as soon as the surface becomes clean. As the part is removed from the treatment solution, the fluids drain back into the tank. Any remaining liquid evaporates and the resin polymerizes. Any oil that is left on the surface as drag-out is trapped in the three-dimensional polymer where it acts as a plasticizer, giving the resin and topcoat combination flexibility and impact resistance. The polymer seals the phosphate coating on the treated part. The treated surface will resist flash rusting for an extended period of time if stored in a dry, indoor environment.

The resin can absorb up to four times its weight in oil, which represents 14 gm/100 ft<sup>2</sup> of oil on the metal surfaces to be cleaned. Since typical oil levels on cold-rolled steel are around 2 to 3 gm/ft<sup>2</sup>, the capacity of the polyphosphate seal to capture the unwanted oil is more than adequate. Parts with very heavy oil concentrations (greater than 14 gm/100 ft<sup>2</sup>) can be treated if the amount

of metal processed is limited to a relatively short run. In other words, it is the average of oils that must be below the 14-gram limit.

While the solution works well with typical mineral-based oils, it is not compatible with water and therefore does not work with water-emulsified oils unless they are dried first. Strong acids, strong alkaline products, or high-melt-point waxes also should be avoided when using the PlafORIZATION process.

The solution is agitated in the tank with educators or venturi nozzles to facilitate removal of particulate through the filter unit. Tanks and circulation systems must be built of stainless steel because the PlafORIZATION chemistry does not react with stainless steel. The tank can also be built with a false bottom so that larger metal particles and parts that fall into it can be easily removed. It is important to provide adequate exhaust around the tank to remove chemical vapors from the plant to atmosphere.

At Smart Manufacturing, parts are dipped in the cleaning solution for approximately 90 sec and then hung to drain and air-dry for 20 min before being placed inside an oven for 20 min to complete the drying process.

çDuring our first year of operation we powder coated approximately 100,000 tubes that were 20" long x 1.5" and never had a problem with pre-treatment quality,é says VanDyk. çOur customer had the least amount of rejects in their history and therefore I am very pleased with the PlafORIZATION process.é They are able to treat steel, cast iron,



**Parts can be densely racked for treatment in the dip tank.**

zinc-coated steel and aluminum in the same solution with good adhesion properties. PlafORIZATION does not provide the extended corrosion resistance that would typically be required for some products that are used in some outdoor applications where high corrosion resistance is important, but performance is typically in the 300- to 500-hr salt spray range, equal to more traditional iron phosphate processes.

In addition to being a very simple process with no waste disposal, the PlafORIZATION product is environmentally friendly and worker friendly. Because of its very low vapor pressure, it is virtually VOC-free. Based on the volatility of the components and their ability to photochemically react in the atmosphere, the estimated VOC con-

**Table 1. PlafORIZATION**

Product	Dip/Flowcoat	Air Dry/Oven Dry	Color of resin	VOC content
<b>Ecophor B700</b>	Dip and Flowcoat	Oven dry	Clear	~ 0 grams/liter
<b>Ecophor B637</b>	Dip and Flowcoat	Oven dry; also, if properly drained, air dries in 30 min at 70°F.	Clear	< 5 grams/liter (< 0.5%)
<b>Ecophor A447</b>	Dip and Flowcoat	Oven dry; also, if properly drained, air dries in 30 min at 70°F.	Slightly yellowish	< 5 grams/liter (< 0.5%)
<b>Ecophor B407</b>	Dip and (if thinned somewhat with its fluids) flowcoat	Oven dry	Slightly yellowish	< 5 grams/liter (< 0.5%)

**PlafORIZATION is available in different grades for different applications.**



**Parts being treated in a spray operation.**

tent for the products ranges from approximately 0 grams/liter to less than 5 grams/liter (0.5 percent). PlafORIZATION products contain no chlorinated fluorinated compounds (CFCs), hazardous air pollutants (HAPs), halogen-containing hydrocarbons (HHCs), aromatic, chrome or ozone depleting substances. Routine chemical titration is not necessary. Chemical analysis is performed every other month by a certified laboratory.

Like any chemical cleaning process, PlafORIZATION must fit the process needs of the customer, and the products to be processed. The soils likely to be present on the part surface must be ones that PlafORIZATION can handle (for example, PlafORIZATION is not a rust or scale remover). Oils must be within the type and quantity range of the chemistry so that they can be effectively removed from the surface without adverse impact on the performance of the chemistry. Parts testing should be done to confirm that the oils present on the part are within the profile.

In the case of Smart Manufacturing, the fit for the soils that they anticipated was very good. Over time, the analysis of the expected soils and the effective use of the PlafORIZATION process have proved out, and successful cleaning and phosphating has worked out very well. Parts are effectively cleaned and protected from flash rusting. Adhesion and field performance have been very good. Although the chemical is more expensive by the gallon than traditional cleaning and phosphating products, it does the work in a single, unheated stage that does not need to be recharged or dis-

posed of. So overall costs per square foot are lower than many traditional approaches and the results on the products are excellent.

Like any process, there is not one size fits all. But PlafORIZATION provides a unique and cost effective way to clean and treat multiple metals in various types of operations that is hard to beat. In addition to batch operations like Smart Manufacturing, PlafORIZATION is used in larger operations, including an in-line dip process for munitions manufacturing and several in-line flowcoat operations.

The newest product is Ecophor B700. It has the best coverage per square foot because its low vapor pressure and high boiling point ensure that evaporation basically does not occur until the parts are placed in the oven to dry. Therefore, virtually all the product not actually used on the part is returned to the tank during drip-off. B700 also uses a new resin that is clear, rather than the slight yellowish cast of the A447 and B407. That is only important for those few users that use a bright white topcoat where a slight yellow tinge may telegraph through the coating.

Ecophor B637 and A447 are essentially the same product, except that B637 uses the new resin. These two products, which have a somewhat lower flash point and higher vapor pressure than B700, can therefore be air dried in a batch process in which there is time to allow 30 min or so after drip-off for room-temperature drying. It is recommended in batch operations where in-plant temperature does not generally rise above 85°F.

Ecophor B407 is a specialty product designed to give up to 72 hr of uncoated salt spray resistance, which it accomplishes by putting on a somewhat thicker seal. It is best used in a two-step process with one of the other PlafORIZATION products as the first step, because the other products have greater oil removal capacity.

At Smart Manufacturing, the primary concerns were waste disposal, simplicity, flexibility for different substrates, low capital costs, low operating costs and limited space requirements. The PlafORIZATION process fit these needs perfectly.

The venture into powder coating has worked out very well for Smart Manufacturing. Although they are open to expansion, possibly an automated in-line flowcoat installation, they are doing well with the flexibility of the batch operation for now. 

*For more information about this process, call Carpenter Chemicals LC at 866-683-1570 or 703-683-1570, or visit [www.cc-lc.com](http://www.cc-lc.com).*