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A New Twist to an Old Song

Organic Film Technology Offers Improvements for Pretreatment

In the music world, we are accustomed to newer versions of old songs. It's happening continuously. Sometimes for the better, but not always so. However, using the right stylized fit and current rhythms, an old hit can become an even bigger one in it's "next life."

This also goes for our industry. New processes, and improvements to established processes, result in a multitude of benefits. These may include quality, wear resistance, environmental stewardship, cost savings, efficiency, and easier handling. One finishing system in particular—iron phosphating—has experienced some interesting and marked improvements through the development of a suitable alternative.

Iron phosphating has been a mainstay in surface preparation prior to application of organic finishes, such as powder coat and paint. Various specifications, which include military and industrial finishes, clearly identify iron phosphating as the required surface treatment. This is simply because iron phosphates provide an excellent base for reception of the organic coating, and contribute toward corrosion protection. Iron phosphates can be applied by soak or spray in manual and automatic systems. The three- and five-stage lines have become synonymous with iron phosphating. With so much going for it, why then consider a change or improvement to this process. For every benefit to the system, there are detriments that are tolerated. These are acknowledged and budgeted, in terms of personnel, time, and maintenance. Some of these negative points include:

- Generation of sludge and scale. The process consists of a chemical reaction that produces sludge by product. Hard water components, especially calcium, form scales. Maintenance down-time is routinely required to clean out sludge and scale. These removed materials must be transported for compliant disposal. The scale is especially a problem for plugging spray nozzles. The associated costs in down-time, labor requirements, additional chemicals, equipment maintenance or replacement, and disposal of sludge are realistic and negative to the bottom line.
- Heating process. Energy BTUs must be maintained in order for proper reaction and application of iron phosphate. These costs are exacerbated by the formation of insulating sludge and scale, as described previously.
- Mildly acidic solution. It will be corrosive to unprotected steel equipment.
- Finite working life for the made-up and maintained bath.
- Analytical control includes titration for concentration of proprietary product, pH measurement, and iron phosphate coating weight determination. Appropriate additions and modifications are made based on actual versus desired results.

Table 1—Comparison of Chemistries

Item	Traditional Iron Phosphate	New Technology
Operating pH	3.5-4.5	7.5-9.0
Buffered	yes (required)	no
Metals	yes	no
Accelerators	yes	yes
Sludging	yes	no
Hard water tolerant	no	no
Fluorides	yes	no
Foaming	low to moderate	low to moderate

Improved Technology

The latest technological developments in surface preparation before paint and powder coating revolve around a suitable alternative to traditional iron phosphating. A critical breakthrough in applied research and development was the identification of a unique class of organic compounds. These entities interact with the part substrate to form a very durable, fixed, dried on organic coating. It resists staining and will not oxidize under the high drying temperatures required before powder coating or painting. The bond between the part surface and organic top-coat has been found to be excellent. Process control can be accomplished by titration of the actives, with no requirement for a coating weight determination. Being almost inert, the new process is not susceptible to sludge formation. The thickness of the organic coating is considered proportional to the concentration. It may be approximately 100 angstroms. Since it is not a reaction product, the composition of the organic coating does not vary. Therefore, the coating is relatively consistent over the exposed base metal. Unlike iron phosphate, the new technology does not contain any of the traditional components found in the former. These include absence of phosphates, fluorides, metal accelerators, and acids. A comparison of these with respect to chemistries is given in Table 1.

The operating parameters do not differ much. This is very beneficial, in that con-

Table 2—Comparison of Processes

Operating Parameter	Iron Phosphate	New Technology
Conc. (liquid)	3-6% by volume	2-5% by volume
Conc. (powder)	4-6 oz/gal (30-45 g/l)	no powder
Spray	15-25 psi	15-25 psi
Time (spray)	30-120 seconds	30-60 seconds
Time (soak)	2-4 minutes	2-4 minutes
Temperature	135-145 degF (57-63 degC)	85-125 degF (29-52 degC)

venient and traditionally comfortable cycle patterns are not interrupted or changed. More importantly, existing three- and five-stage process machines can be used with the new technology. It conforms to the equipment and operating cycle of the iron phosphate system. Cleaning, however, is best accomplished similarly to iron phosphate, in a traditional spray or soak cleaner before application of the organic film. Iron phosphates, however, have an advantage, in that cleaning and iron phosphating may be accomplished in the same process solution. The conversion from one process to the other can be readily accomplished. Table 2 compares the processes.

Water hardness components, such as calcium, will detrimentally affect both processes. Therefore, the use of distilled or deionized water is recommended. The new technology operates at a near neutral pH, thereby simplifying effluent solution pH control. It will also not be corrosive to unprotected steel equipment. Because it is a non-phosphating system, the system is non-sludging. Operating at a lower bath temperature range, energy savings are realized through less BTU demands. These benefits can be magnified as follows:

- Non-sludging results in plant operating cost savings in several ways. Line shutdowns to service the surface preparation process tank and equipment are virtually eliminated. No sludge to clean out. Sludge removal may cost from 5 to 6 figures annually. Labor costs and scheduling to clean up the line during shutdowns can be quite expensive. Add to this the downtime when production completely ceases. The previously required spraying of sludge dissolving descalers is no longer necessary. Nozzles are not as readily serviced and replaced. The disposal of sludge requires DOT compliant packaging and transport. It also requires another corporate signed check. Who enjoys filling out RCRA paper work and manifests?
- Operating temperatures are reduced by approximately 25 percent in the new process. Current energy costs have become a major source of expense. This significantly lower energy demand, such as the use of natural gas, becomes very attractive to the bottom line.

The iron phosphate and new technology both readily prepare ferrous and non-ferrous surfaces before paint and powder coating. The non-ferrous materials include aluminum, magnesium, and zinc alloys. Various organic top coats can be applied, including: epoxies, polyesters, polyurethanes, hybrids, and urethanes. Both systems meet the requirements of adhesion and corrosion testing. Examples of these are ASTM B-117 (neutral salt spray) and ASTM D 3359 (cross hatch and tape). They are compliant with other methods for adhesion, such the reverse impact test. In fact, the new technology has been found to outperform iron phosphate in some of these test methods.

The new technology has been patented. Certification and acceptance is on going to get it additional approval in the appropriate organic finishing industries. An attractive sidelight to the new technology is it's favorable impact to environmental stewardship for the user. Surface finishing is continually experiencing new, dynamic developments and improvements. The organic film technology as a suitable alternative to iron phosphate is one such exciting breakthrough.

Fact or Fiction? *Continued from page 31*

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