Pretreatment Chemistry and Equipment Improvements

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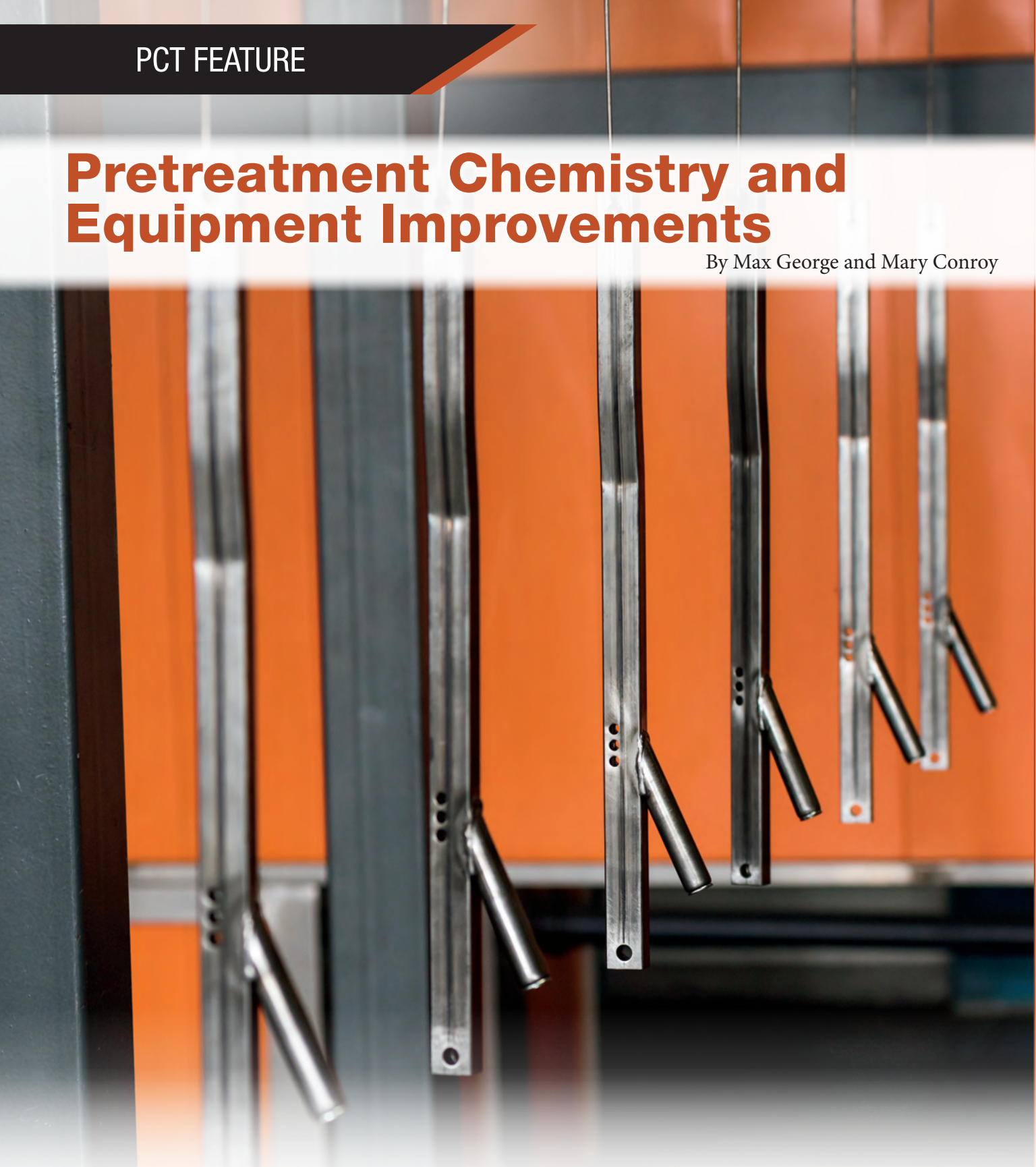

When an OEM or job shop begins the journey to transform their company and take on a lean mindset, they tend to start by looking at areas that appear to be the most noticeable such as dated machinery, labor intensive areas, or bottlenecks in the process. An often-overlooked area in this ideology and practice is the pretreatment process for a paint line.

The pretreatment process is often viewed as an area where "if it isn't broken, don't fix it." The chemistry that has been used in the line has been used there for many years and the operators do not even need to review the manual because they know the testing and procedures so well. Typically, the only interest in changing chemistry or reviewing the process is if the exact same chemistry can be provided for a lower cost. However, in recent years, many solutions have been developed for pretreatment systems with the goal of drastically reducing the footprint of the process. Exploring new chemical and process options in pretreatment can be daunting. The devil is often in the details with pretreatment chemistry and system monitoring, and the thought of changing chemistries or refining the pretreatment process can be overwhelming. However, by working closely with your chemical supplier, there can be substantial cost savings to be found.

Cleaning

Historically, parts have required their own higher temperature cleaning stage prior to the pretreatment stage. This generally involves a highly caustic, alkaline cleaner and needs significant heat to minimize foaming and effectively clean the parts. Often these chemistries use phosphates, silicates, or solvents that may have environmental or safety concerns. These additives, while increasing the efficacy of the cleaning step, can significantly add to the cost of your operation, both through safety precautions that must be taken given the associated risks and the wastewater collection and treatment.

Cleaners have been developed over the past ten to 20 years to maximize the technology provided by low foaming surfactants to create effective cleaning at low temperatures (around 100 degrees Fahrenheit) with the use of no phosphates, solvents, or silicates. These chemistries also have little to no caustic properties in them which allows for multi-metal processing alongside ferrous cleaning. Reducing the temperature of your cleaning step will save you money in several ways: lower energy costs by reducing heat, less water usage by decreasing evaporation, and chemistry cost savings from decreasing the number of adjustments required as water is evaporated and replaced.

Some chemical suppliers have taken an additional step in developing environmental and safety-conscious cleaners by voluntarily partnering with the EPA Safer Choice Program. Products that carry the Safer Choice emblem have passed the EPA's rigorous criteria for safety and sustainability. In this process, every ingredient, no matter the concentration, and packaging component is reviewed for their impact on both human health and the environment. A certain pH range must be met to lessen potential for irritation or injury, and the product must be free of volatile organic compounds (VOCs) to minimize air pollution and respiratory risks. To ensure that these lower-impact products actually work, they must also pass category-specific performance standards and perform comparably to or better than common products in that category. Choosing a safer product that is proven to perform can quickly generate savings in safety training and safeguards, energy usage, wastewater treatment, and more.

It's also important to mention an individual cleaning step may not be entirely necessary for your process. In many cases, a surfactant package can be added to an iron phosphate pretreatment system to combine these two steps into one stage. Exploring the technology of iron phosphate cleaner-coaters can result in substantial cost savings for a paint pretreatment line and overall operation. If you can make the switch, you could remove at least one, possibly two, stages from your process. This would result in immense water, heating, maintenance, and chemical savings for your line.

Cleaners have been developed over the past few decades that are more efficient and have less environmental impact.

Pretreatment

The past thirty years have given way to a new wave of developments in the pretreatment world.

Many pretreatment chemistries were originally introduced to the industry ripe with unrefined characteristics. Over time and through generations of formulas, chemical manufacturers have been able to narrow down the problems and limitations that existed in many of those technologies. Through this process, many have also

gained new certifications and qualifications from the major OEMs that have allowed these products to gain much wider acceptance.

For many years, zinc phosphate pretreatment chemistries have been a cornerstone of manufacturing. Although zinc phosphate will continue to be used by manufacturers due to its many aerospace, military, and OEM approvals and specifications, in the past ten years, zirconium has emerged as the widely accepted industry favorite. It has been developed into a trusted product that can be used in many of the same specifications and processes.

Upgrading a process from zinc phosphate pretreatment chemistry to zirconium offers a wide variety of process benefits and cost-saving opportunities. Most zinc phosphate systems require a bare minimum of five stages and can often involve seven to eight stages to achieve the high-quality finish the parts need. A zirconium system can normally give comparable results in five stages or less. If utilizing an existing washer, making the switch will reduce your energy, water, and chemical costs, and if building a new washer, in addition to these savings, you will also save on real estate in your plant. Zirconium pretreatment processes can also run at ambient temperature, a significantly lower temperature than a zinc phosphate bath, saving on water and energy, and produce far less sludge than a zinc phosphate bath, reducing nozzle maintenance, increasing equipment life, and saving time and labor when dumping and recharging a bath.

Iron phosphate chemistries have also been around for quite some time, and while they are very forgiving and easy to use, they pose significant concerns as phosphate and wastewater restrictions tighten. This will only continue as time goes on. Zirconium technology has reached a level of development where it is much easier to control and give predictable results, allowing many companies to begin to make the switch. As previously noted, zirconium pretreatment systems have evolved to a superior level where even less than five stages may be all that is required to achieve results comparable to that of iron phosphate. Using a mildly alkaline cleaner in stage one of a conveyorized spray washer, followed by a clean rinse with overflow, and using zirconium pretreatment as a dry-in-place seal, a zirconium pretreatment system can replace the clean/coat, rinse, and seal that is often seen in smaller iron phosphate washers. Making the switch from iron phosphate to zirconium can reduce the water, energy, and chemical consumption of your washer while removing the phosphate concern from the waste stream.

Process Monitoring

In addition to the actual chemistry being placed in the bath, there have been great advancements made in data-driven monitoring systems that can help keep your process in line. Many of these advancements center on manufacturing's absolute reliance on consistency and reliability. If problems arise in the pretreatment process, the impact to the business can be substantial. There could be mechanical failures, lost revenue, increased health and safety risks, and part failures that can cost precious time and energy, and company image if those failures make it all the way to the customer.

Analytic-type platforms continually collect data to allow manufacturers to both proactively monitor their systems and react swiftly and concisely when abnormalities occur. These platforms use in-process sensors to monitor the pH, conductivity, temperature, and concentration in the cleaner, rinse, and pretreatment stages. This data can be graphed and charted over the course of a bath's life alerting management to address complications at the first sign of trouble. Adjustments can be made and affected parts can be checked before reaching the field, allowing manufacturers to increase their efficiency and reduce risk of overspending on chemicals, repairs, or

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recalls. It can also reduce labor for auditing purposes, as data points and reads are safely stored in one convenient location for use during internal or external audits.

Continuous improvement and cost reduction can be difficult. We often fall into the misconception that these initiatives are chores that inevitably lead to a decrease in quality or are large overhauls that require significant upfront capital that later returns the investment. However, in approaching these goals from a pretreatment chemistry and equipment perspective, we can discover a variety of under-utilized opportunities to modernize a process. Consider these tried-and-true solutions to effectively begin saving on labor, chemistry, water, energy, and more.

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