TN00-068
November 1999

WMRC Technology Update

Nitric Acid Pickling Bath Recovery

Gerlin Inc., located in Carol Stream, IL manufactures stainless steel pipe fittings and flanges. As part of Gerlin's process, stainless steel parts undergo a pickling bath step to provide the parts the required surface quality.

Gerlin maintains a 1,500 gallon pickling bath using nitric acid and ammonium bifluoride. The bath becomes depleted in 6-8 weeks and is recharged seven times per year. Gerlin's waste disposal costs run $18,000 per year and fresh chemical make-up costs are $13,000 per year.

Besides becoming depleted, the pickling process is also a bottleneck in Gerlin's operation. During the 6-8 week cycle, pickling times can range from 30 minutes to 6 hours. Often, even after 6 hours of pickling, hand cleaning and repickling were required.

WMRC engineers developed a pilot project using diffusion dialysis acid recovery technology to assist Gerlin.

A pilot scale diffusion dialysis unit rated at 5-gallons per day was used for this project.

Diffusion dialysis employs a highly acid selective membrane to split the contaminant wastestream into two, a purified acid stream and a metal reject stream. Acid recovery rates of 80 percent and metals reject rates of 90 percent can be achieved.

The Gerlin pilot project proved to be very successful. The diffusion dialysis unit recovered 86 percent of the nitric acid and 30 percent of the ammonium bifluoride. The unit also rejected 88 percent of the iron, 89 percent of the chromium, and 80 percent of the nickel.

Implementation of diffusion dialysis will increase Gerlin's productivity as a result of reduced down time, reduced pickling time and reduced rework. These factors were the company's foremost decision to implement the technology.

Additionally, implementing diffusion dialysis at Gerlin will reduce pickling bath discharges from seven times per year to twice per year, providing a savings of more than $10,000 per year.

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as an insulator; once the object is covered, it can take no more paint.

The atomizing for an electrostatic spray gun can be air, airless, or rotary atomized. Air atomized spraying has a transfer efficiency of 60 to 70%, airless runs from 70 to 95%, and rotary goes from 80 to 90%.

The disadvantages are: only one coat is possible, only conductive materials can be painted, it's more expensive, slower and has higher maintenance costs, is limited to chargeable paints, and the surface of the object must be extremely clean. Because the gun uses electricity, this method presents a possible shock hazard. Another problem with electrostatic spraying is that the paint is attracted to all grounded objects, not just the object to be painted–the conveyor and conveyor protection systems in assembly line painting, the paint booth ceiling, the spray gun and the spray gun handler. Work has been done on developing a electrically charged paint repelling panel to protect against stray paint. A repelling panel is not 100% effective, but it does cut down on problems from stray paint.

Powder Coating

This uses the same principle as electrostatic spraying, but sprays something a little different, powder paint. The object then moves through an oven, and the powder melts into a smooth, durable coat. Overspray can be reused, and no other pollutants are created or released because the powder contains no solvents. The equipment for powder coating is expensive, so it may be economical only for larger businesses. Objects that are powder coated must be able to withstand the oven curing, about 350°F for 30 minutes, without any loss of strength. Most metals, except aluminum, can be powder coated.

A variation of this is plasma powder coating. The powder is fed into an extremely hot gas stream–5,000° to 15,000°F–and is then sprayed at the object. Application and curing occur at the same time. Plasma powder coating is for large objects that can't fit into a conventional curing oven or that would lose tensile strength in a conventional oven. Overspray cannot be reused because it hardens. Because of the high temperature spray, protective equipment is required.

Another variation is flame sprayed powder coating, where the powder is melted with a high temperature flame. Again, it is for large objects and overspray cannot be reused.

Powder coats can also be applied by a fluidized bed of powder. Air is mixed with the powder, essentially creating a dense cloud of paint powder. The object to be painted is preheated, dipped into the bed, and then cured.

The paint powder itself comes in two varieties, thermoplastic and thermosetting. Thermoplastic paints melt repeatedly on exposure to heat and set again on cooling. Thermosetting paints undergo a chemical change during curing so they become stable.

For Further Information

Chemical Coaters Association International
513/624-6767
www.finishing.com/CCAI/index.html

National Paint and Coating Association
202/462-6272
www.paint.org

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