

Case Study



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Lorin Industries *Muskegon, Michigan*

REDUCING WASTE AT LORIN

Lorin Industries, located in Muskegon, Michigan, is the world's largest volume job shop coil anodizer of aluminum. Its six continuous coil anodizing lines are operated with cutting edge technology. Lorin's commitment to excellence is shown in its products and employees. Each of the company's 150 employees is dedicated to manufacturing the best product with virtually zero waste.

THE ANODIZING PROCESS

Anodizing of aluminum is a fairly old process. It has been used commercially for over 70 years. However, in the last 35 years, coil anodizing has expanded applications through the economies of continuous coil processing.

How is it done? In anodizing, an aluminum oxide coating is formed on aluminum by passing an electric current through an acidic solution to the aluminum. The aluminum oxide has a porous structure that allows it to grow to a thickness of several thousandths of an inch. In coil anodizing, a layer of one-half a thousandth of an inch is seldom exceeded. The pores allow the coating to be colored by absorption of an organic dye or plating of metal into them. A sealing reaction locks the colorant into the coating structure and provides corrosion resistance. Selected operations

prior to anodizing modify the appearance of the product by etching the surface to a flat appearance or brightening to a mirror-like surface.

RECYCLING

At a glance, it is easy to see that Lorin Industries has woven waste reduction into its corporate culture. The company realized the importance of recycling scrap aluminum and instituted a classic recycling program, which was spurred by a philosophy of reusing materials when justified by resale value. At Lorin, avoiding landfilling is as important as product quality. In 1992, Lorin sold roughly 1.5 million pounds of aluminum scrap. Steel bands, which hold the coils of aluminum to a wooden skid, are chipped and sold. The skids are reused if possible, rebuilt if necessary and, if beyond

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February 1996 • #9407A

AUTHORITY: PA 451 OF 1994 TOTAL COPIES: 1000
TOTAL COST: \$82.29 COST PER COPY: \$.08
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repair, chipped for landscaping mulch. Also, Lorin recycles its solid waste, including office paper, newspapers, and magazines.

CHEMICAL RECOVERY

Waste reduction at Lorin goes beyond recycling scrap aluminum; conserving and reclaiming liquids are also part of the program. Lorin uses large volumes of sulfuric acid, phosphoric acid, and sodium hydroxide in its anodizing process. It did not take management long to realize that a reduction in chemical usage directly translated into big savings in raw material and disposal costs.

How does Lorin recover phosphoric acid? In anodizing, aluminum is immersed in a brightening solution of phosphoric acid. Some of the aluminum dissolves into solution. When the concentration of dissolved aluminum builds to a certain level, the solution becomes contaminated and must be replaced. Lorin devised a method to rejuvenate the solution. First, the solution is passed through an ion exchange column to remove as much aluminum as possible. Next, the aluminum-free solution is concentrated by evaporation and returned to the process tank for reuse. This two-step process saves Lorin \$400,000 each year in chemical and disposal costs.

Sulfuric acid is recovered using the same scheme without an evaporator. Lorin is looking into installing an evaporator to recover even more acid from rinse water. Sulfuric acid is inexpensive, but neutralization of the acidic waste is quite expensive. Another alternative is the manufacture of alum from the waste stream derived from the sulfuric acid recovery system.

WASTEWATER PRETREATMENT

Conservation of resources is not just limited to anodizing. Lorin is practicing waste reduction in its wastewater pretreatment process, too. Process wastewater is treated collectively in the company's wastewater pretreatment system. For example, rinse water and by-products from the acid recovery systems are pretreated before discharging to the Muskegon

County Wastewater Management System. Lorin saved money by neutralizing process wastewater using lime produced nearby at a company that manufactures acetylene (lime is a by-product). Lorin found this lime to be cheaper than the sodium hydroxide it previously used to adjust wastewater pH. It is interesting to note that using a less expensive neutralization product results in lower realized savings from acid recovery processes. Overall, however, the savings are greater.

Using lime has spurred Lorin to look at installing a caustic etch recovery system to recycle sodium hydroxide. The process would also produce alumina trihydrate, a marketable by-product. It would, of course, add another processing system to be monitored and controlled.

WATER CONSERVATION

The company is actively searching for new ways to reduce water consumption. Beyond the obvious savings in water and sewage charges, Lorin believes it can recover more process chemicals from rinses by creating a more concentrated stream using counter current flow rinses.

ENERGY CONSERVATION

Lorin has reduced its energy costs. In 1991, the company installed a cogeneration system consisting of four 1,100 HP Caterpillar natural gas-fired engines generating 800 kilowatts of electricity and 2,380 pounds of steam per hour. In 1994, the system provided about 50 percent of the electrical and about 80 percent of the thermal energy needed by the company. Company officials estimate the savings to be about \$540,000 per year. The overall payback time is four years.

These are just a few examples of how Lorin has reduced waste and saved money. With waste reduction ingrained in production, maintenance, and purchasing, it will not be long before Lorin reaches its ultimate goal of zero discharge.

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