Powder Coating:

An Environmentally Friendly Alternative to Electroplating



manufacturers for years.

he decorative powder coating market in the U.S. has experienced substantial growth over the past 10 years.

for publication.

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This discussion on powder coating applications tied for "Excellence in Presentation" at the Symposium for Organic Coatings, AESF Week 1993 at Orlando, FL. Presented by P.R. Osborn, the discussion examines some environmental and cost-saving aspects of powder coatings and how they can be used to simulate other surface finishes. The presentation has been edited

In 1982, the decorative powder market was barely more than 21 million pounds. Since then, the industry has experienced a growth rate of nearly 20-percent each year. Nearly 149 million pounds of decorative powder was sold by the end of 1992, according to the Powder Coating Institute. That's about 19 percent more than consumption in 1991.

Powder coating growth has traditionally come at the expense of finishing operations employing liquid baking enamels, two-component paints and, to a lesser degree, air-dry enamels.

The electroplating industry faces many of the same challenges encountered by the organic liquid finishing industry. Accordingly, there are several compelling reasons for electroplates to consider powder coating as an alternative finishing option.

Environmental Considerations

If you have been even remotely involved in the metal finishing industry, the following environmental considerations are all quite familiar:

- Superfund
- •Clean Air Amendment 1990
- •Environmental Protection Agency
- •The Resource Conservation Recovery Act (RCRA)
- Cradle-to-Grave Responsibility

The majority of powder coating materials used now are considered "environmentally friendly." Powder coatings are essentially 100-percent solid materials. This eliminates the need to use solvents, expensive filtering, incineration, or solvent recovery systems to arrest volatile organic compounds (VOCs). Most formulated powder coatings are classified as non-hazardous and are not subject to the reporting requirements of SARA Title III, Section 313.

The environmentally friendly aspect of powder coatings can significantly reduce the cost associated with handling hazardous materials. The elimination of hazardous compounds can also greatly minimize or completely eliminate potential environmental liability. The resources needed to implement and monitor clean-up or compliance programs can be directed elsewhere. Plant safety is improved because of the absence of acids, caustics and other hazardous products. Employees operate in a safer and

Table 1 Applied Material Cost						
Waterborne	Conventional Solvent-Based	High Solids	Powder	Chromium Plating		
Applied Cost .066 Per Sq-Ft In Cents	.062	.055	.045	?		

Table 2 Product Comparison: Chromium-Plated vs. Powder-Coated Steel					
Property	Test Method	Nickel-Chromium	Hybrid Powder		
Impact Resistance Direct, InIbs Reverse, InIbs	ASTM D2794	160 160	160 160		
Crosshatch, Adhesion	ASTM D3359A	5B	5B		
Flexibility, In. Radius	ASTM D1737	1/8	1/8		
Pencil Hardness, Scratcl	hASTM D3363	6Н	2H		
Salt Spray, 48 Hr	ASTM B117	Minor	No effect		
		field rusting			
500 Hr:		Minor creepage, field rusting	Minor creepage, no blistering		

more productive environment. Insurance premiums are usually reduced.

When powder coatings require disposal, most are considered non-hazardous and classified as a nuisance dust by land-fill operators.

The non-hazardous composition of powder coatings eliminates the "cradleto-grave responsibility" that could be a major concern for generators of hazardous waste who must contract for the services of waste disposal companies. The probability of legal action based on environmental wrongs is minimized by the reduction or elimination of many cornpounds and discharges associated with an electroplating operation.

The "green movement" continues to raise public awareness of the need to control emissions from industry. The Clinton administration has made it a priority to address the concerns of the public about air, water, and ground contamination. Powder coatings represent goodfaith efforts by metal finishers to be "good neighbors."

Economic Considerations

It is extremely difficult to compare the applied cost of a powder-coated sub-

strate to a "typical" plated substrate. A cost comparison analysis commonly used in the paint industry to estimate liquid

finishing costs entails the following aspects of the finishing process:

- Material cost
- Spray booth exhaust
- •Cure oven
- •Total energy cost
- Labor
- Maintenance
- Sludge disposal cost

The type and quality of electroplating products varies widely. Accordingly, the applied cost of electroplating will also vary. Undoubtedly, a quality electroplating operation will be able to determine the cost per foot of its operation. For the purpose of comparison, some "real world data is presented in Table 1 to provide some operating costs perspective for several finishing technologies.

Powder coating technology can afford significant cost savings related to waste discharges, environmental compliance and energy.

Capital expenditures for equipment have not been included in the cost comparison. The capital outlay for an electroplating system is assumed to be higher than that for powder coating, increasing the amortization expense and lengthening a company's return on investment.

Physical Properties & Appearance

Comparing powder-coated substrates to electroplated substrates is truly the proverbial "apples and oranges."



This product is an example of a powder coating that is intended to replicate an electroplated bright brass appearance.



This product demonstrates a powder coating that has been developed to simulate a zinc plated **surface** and a silver anodized look.

The physical performance capabilities of many types of electroplating certainly surpass those of powder coatings. Table 2 shows a product comparison of a nickel-chromium-plated surface versus a powder coated substrate.

While powder coatings will not meet all the physical properties of a plated surface, powder does offer an extremely durable performance option.

Powder coatings offer a great deal of versatility in appearance options. Attempts within the powder coating industry have been made recently to produce a chromium-like appearance. Attempts have also been made to simulate anodized and brass surfaces. These techniques have found some acceptance in the market.

There are many other different appearances available with powder coatings. The silver vein and gold vein appearances have been commercially available from powder coating manufacturers for many years. These surfaces have found wide acceptance within industries that utilize tubular steel and fabricated wire. The "silver vein" has recently come in vogue with point-of-purchase store fixture manufacturers for replacing nickelchromium and zinc-plated products.

Reverse veins are becoming more popular in other industries. The technique has been prominent within a styling trend known as the Euro-look, which essentially entails an all-painted surface in lieu of any plated surfaces. Companies promoting the Euro-look emphasize the styling and design options available with powder coating.

A relatively new approach, referred to as a "bonded leafing aluminum," is the powder industry's best effort to simulate the bright luster of a chromium finish. While the appearance is respectable, there are some substantial physical film properties that must be sacrificed to attain the appearance with the bonded approach. For example:

- •Salt spray resistance is rather poor (less than 48 hours).
- Exterior exposure is not recommended unless a clear, weatherable topcoat is applied over the bonded leafing.
- Mar and abrasion resistance are rather poor.

An approach using a "treated aluminum" pigmentation has been developed to simulate both a zinc plated surface and a silver-anodized look. This technique does not maintain the same degree of luster as the pseudo-chromium appearance of the "bonded aluminum," though it does have an appearance that is very eye appealing.

The advantages over the bonded leafing aluminum include:

•Excellent corrosion resistance (1,000 hours over a Bonderite-1000 panel)

•Good impact, flexibility and mar resistance •Improved exterior exposure capabilities •Available in a one-coat application Another technique incorporates a tinted clear-powder coating over a nickel-chromium or highly polished stainless steel substrate to replicate an electroplated bright-brass appearance.

Substrate preparation to achieve the bright-brass look is considerably more intensive than traditional substrate preparation for powder coating, which minimizes the potential savings.

Film thickness control is essential because of the transparent nature of the pigmented powder coating. Heavier film thickness will demonstrate a darker color because of the increase in opacity of the cured powder-coating film.

A gold-anodized look, achieved in a weatherable polyurethane chemistry, is another process that will enable powder coaters to compete with electroplates when extreme exposure durability is not required.

The finishing industry will continue to face environmental pressures, While no one finishing technology offers a panacea for every environmental concern, powder coating does offer a finishing option with tangible economic and environmental advantages. •

About the Author

P.R. Osborn is business manager of the Powder Coatings Division of Lilly Industries, Inc., Kansas City, MO. He has been involved with powder coatings for 17 years. His responsibilities have included technical service, field sales, sales management and business management. He received his degree in business administration from Kansas State University. His background also includes experience with high solids, conventional solids and waterborne coatings, urethane foam, polyester gel coats and laminating resins,