When Good Parts Coat Bad: Stripping Reject Components to Salvage Profits

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When coating difficult parts or when line upsets occur, defects result. A dependable and versatile stripping process is essential to not only reclaim bad parts but also to recoup the monetary investment they represent. With continuing efforts for cost reductions virtually universal in industry, defect salvage management may be an undervalued activity.

On average, the overall coating industry runs about mid-single digits for rejects due to coating defects. Of course, the more stringent your quality requirements, the higher the coating defect rates will be. Coating lines that must produce "Class A" finishes can hit about a 10 percent defect rate on average, while general industrial finishes for function and good aesthetics can run at 2 percent to 3 percent. Substrate materials and part geometries also can greatly influence reject rates.

The first goal is not to produce coating defects. There are a number of standard practices that should always be evaluated when working toward higher product quality and reduced reject rates. These include proper pre-cleaning and pretreatment of work, proper application equipment maintenance and settings, quality coating materials, and rack cleanliness to promote good part grounding. On high production lines, even fractional percentage yield improvements can translate to many thousands of additional good parts. All of these factors work in concert to produce good finishes of predictable and reproducible quality and to minimize coating defects.

No matter how efficient and productive a given finishing line is, there will be reject parts that will require refinishing. Historically, spot sanding and finessing followed by recoating have been the main techniques used for rework. Often, if a second pass through the finishing line is not successful, a third pass through is sometimes used. Unfortunately, it is not uncommon for a defective part to have three or more passes through the finishing line when it is finally relegated to complete stripping or is scrapped out.

Figure 1

Clear Coat Adds Value

The clear topcoat applied to this aluminum wheel provides additional value to an already valuable part by further enhancing and protecting the underlying surface.

In general, it is more effective to transfer defective parts to stripping operations when the defect is first identified, rather than attempt to "fix" the defect by recoating. This frees up valuable line capacity for making additional good parts, and saves coating.

For complete coatings removal, chemical strippers have been widely used with good results. Care in selecting the proper stripper for a given substrate is essential to prevent unwanted base metal attack or unwanted surface dulling. Ideally, a chemical stripping system should be compatible with a range of substrates and effectively strip a variety of coatings, including electrocoat, powder, liquid, base coat/clear coat, multi-coat combinations. It also should not dull or etch highly polished surfaces, it should be environmentally benign, and it should provide good value.

It is not uncommon for well-stripped components to have a higher yield upon recoating than that achieved for first-run parts, further encouraging defective parts to be stripped after only a single pass through the line.

In many production environments, the coating operation is the last step performed prior to final inspection and shipping. For good coating defect reclamation and management, a stripping process that allows defective parts to be stripped and reclaimed, while preserving as much of the value-added operations that were invested into the part initially, is needed.

Examples of these value-added operations include:

- Buffing and polishing automotive wheels, faucets and hardware.
- Patination and other metal coloring treatments.
- Selectively plated substrates.

Most of these operations are unique to parts that are subsequently clear coated. In these cases, preservation of the polished, oxidized and/or plated surface is essential; the clear topcoat further enhances and protects the underlying surface (**Figure 1**). Other benefits can be realized when dissimilar or reactive metals need to be stripped, including:

- Galvanized steels.
- Magnesium electronic enclosures.
- Aluminum.
- Multi-metal substrates.
- "Red" metals such as copper, brass and bronze.

All of these conditions represent significant investments of materials and labor, which can be difficult or impossible to preserve with conventional rework or stripping techniques. Advanced chemical stripping processes, however, may offer great potential for part recovery and significant monetary recovery, too.

In addition to the physical salvage of coating-defect components, there can be significant impact on upstream materials and processing resources with good defect management. Not only are the costs associated with replacing defective parts potentially eliminated, the production resources that would have been required to replace the "bad" parts are now available to make other salable goods (and profits). Carrying this rework vs. replace strategy further leads to potential savings in rescheduling, overtime, additional production equipment and rush shipments. These indirect potential savings need to be considered when making the ultimate scrap vs. rework decision.

The reject component has intrinsic value based on the raw materials consumed and the manufacturing costs associated with its production. This value then can be further enhanced by considering items such as scheduling issues, production lead times and shipping commitments. Recognize and accept that stripping cannot repair physical rejects; stripping can only salvage coating defects.

One final consideration when making the

scrap vs. salvage decision involves whether the components are normal production parts or specials. There are instances when coating defects occur when prototype, one-off or restoration-type components are coated. In these instances, a dependable and effective coating removal process can be invaluable. Usually there is no question whether to reclaim these types of parts; you do not have any replacement parts available.

Novel Stripping Process

Advanced chemical stripping processes should fulfill as many of the desirable criteria as possible. In addition, safety and environmental impact also must be considered.

Recent advances in chemical formulation and processing techniques has produced a reliable and flexible process. A single process is capable of stripping a range of coatings, including electrocoat, powder coatings, base coat/clear coat, and various combinations of these coatings. Incidental soils, oils and other contaminants also are effectively removed from the defectively coated components during the stripping operation. Substrate metals can include ferrous and non-ferrous materials.

Used full strength without dilution, it operates at a nominal temperature of 300°F. Although its operating temperature is higher than most commercial strippers, the metallurgical properties of substrate metals are virtually unaffected by the process. Broadly stated, if a metal's properties are not adversely affected by conventional curing temperatures of 300 to 350°F, that same metal should not be adversely affected by this stripping process. Organic coatings are removed during the stripping process, but the galvanized coating is unaffected (**Figure 2**). Evaporative losses from the process are also quite small as the vapor pressure at operating temperatures is low.

How It Works

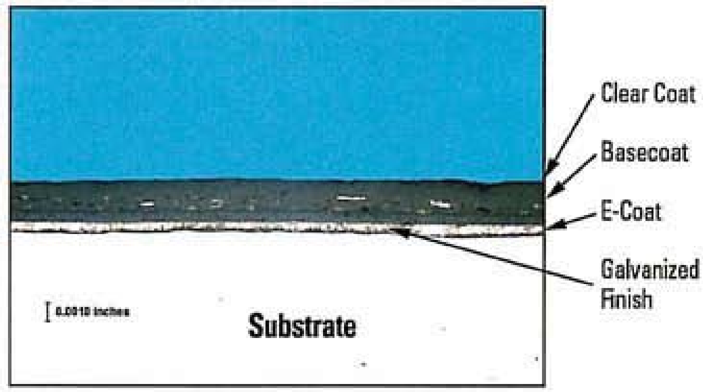
The basic stripping reaction involves the dissolution of the cured coating. As such, the organic portion actually goes into solution, with the common inorganic fillers remaining in suspension. Once the stripping is complete, the components are allowed to drain and then water rinsed.

Because the coatings do go into solution, the life of the process chemical is finite. Useful life varies from application to application and is influenced by the type(s) of coating(s) to be removed and the physical complexity and geometry of the parts being stripped.

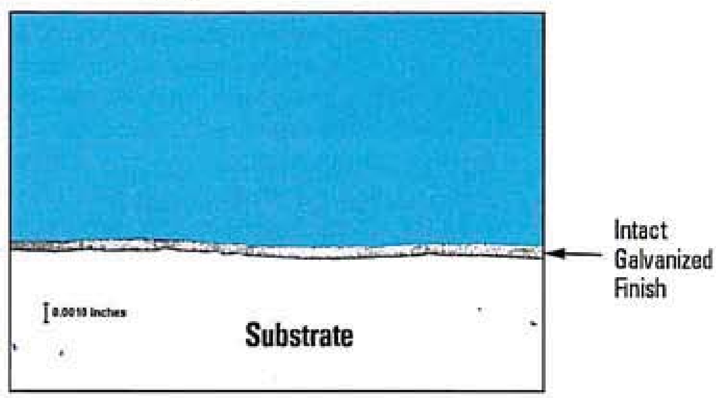
Figure 2

Layers of Organic Coatings Removed from a Rail

The layers of organic coating have been removed from half of this rail.



The photomicrograph shows the layers of coating on the rail before stripping.



This photomicrograph shows the substrate and the galvanized finish intact after the layers of organic coating have been removed.

Required stripping times depend on the thickness and type of coating(s) to be removed and bath loading. They generally range from 10 to 15 min for a single layer of electrocoat to 90 min or more for multi-layer coatings. Because of the benign nature of the process, little or no base

A typical stripping system includes the solution tank and a rinse tank.

metal changes are observed even during extended exposures to the stripping process. The process also is capable of removing multiple layers of assorted coatings, e.g., e-coat + powder, e-coat + liquid base coat + liquid top coat.

Once the coating has been removed in the stripping process, downstream process steps are heavily dictated by the component being stripped. In its simplest form, the stripping process consists of:

- Stripping process tank.
- Agitated ambient temperature tap water rinse.
- Agitated second tap water rinse, ambient or heated.

From these basic elements, the complexity and customization of the process may increase. Additional process steps are dictated by component substrate, its geometry and surface finish requirements. The more common process adjuncts can include:

- Post-cooling station.
- Ultrasonic water rinse.
- Pressure spray rinse(s).
- pH control system for rinse(s).
- DI water final rinse.
- Water blow-off, dryers, etc.

Post treatment processes such as rinses and pH control are as important as the initial stripping operation to produce an acceptably stripped part. For captive stripping installations, it is relatively easy to tailor the proper states and sequence of operations.

For custom coaters that want to have this capability, multiple post treatments may provide maximum flexibility in salvaging a range of customers' parts. In this environment, the multi-metal/multi-substrate capability of the stripping process is a major advantage vs. many substrate-specific stripping processes.

The novel stripping process described above presents an advancement in flexibility and function vs. other processes used to recover parts with coating defects. Environmentally benign with broad coating removal capabilities, it also can be used on just about any metallic substrate without attack. Moreover, it also can preserve many value-added operations such as polishing, buffing and antiquing to salvage the true value of the reject – and its potential to contribute to profits, too.

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