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# Preparing Plastics for Painting

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There are a number of reasons to paint plastics. Some are painted for appearance; others for functional purposes.

Often the objective of painting a plastic part is to achieve the smooth, mirror-like, automotive "Class A" finish. The molded surface of non-painted plastic usually doesn't have this desired appearance. The paint covers molding and substrate imperfections. Also, decorative effects such as metallic finishes, textures and color match of differently processed parts can be achieved by painting.

Paint sometimes acts as a sealer and protection against weathering. Some plastics fade without paint protection. In the electronics industry, conductive paints are used on cabinets for electromagnetic interference (EMI) and radio frequency interference (RFI) shielding.

**Paintability.** Most plastics, after being cleaned of all soils, are paintable with the right kind of paint. However, some plastics will not accept paint wet-out or adhesion even when the surface is completely clean.

The old standard in the metal industry, to determine if a part is clean for painting, is the "water-break-free" condition where water will sheet over the surface.

This cannot be used as a cleanliness indicator for plastics. The surface tension of most plastics, even when clean, will not allow water to spread and sheet.

One method employed for predicting paintability is to pour alcohol, such as isopropyl alcohol, on the part. If it beads up, the surface is not adequate for paint adhesion. If it wets the surface, adhesion should be satisfactory.

However, the only accurate way to predict paintability of a plastic is to try to paint the plastic.

**Pretreatment for Hard-To-Paint Plastics.** Polyolefin-type plastics, such as polyethylene and polypropylene, have surfaces that are wax-like and are not readily painted. Special pretreatments are necessary to paint polyethylene. Some of these are flame treatment, acid treatment and corona discharge. An example of an acid treatment solution is five pct potassium dichromate and 95 pct concentrated sulfuric acid. These treatments incorporate oxygen into the surface structure of the plastic and increase the polarity for improved paint attraction.

Another method of increasing paint adhesion by oxidation is to coat the plastic with benzophenone and then expose

the surface to ultraviolet radiation.

With innovations in painting systems, painting of polypropylene plastics no longer requires special pretreatment. Adhesion-promoter coatings supplied by paint companies are used to prepare these surfaces for painting.

Vapor etching with chlorinated solvent is also used on some plastics. This exposure swells and roughens the polymer surface, which improves adhesion. However, distortion of the plastic can occur. Use of solvent vapor etching is on the decline because of its environmental limitations.

**Soils and Mold Releases.** Before attempting to paint even the easy-to-paint plastic, the surface must be clean. The most common soils are shop soils, material handling soils, machining soils, plastic sanding dust, fingerprints and mold release. Of these, the mold release can be the most difficult to clean.

Mold releases should be used sparingly on parts that are to be painted. Water-soluble, soap-based mold releases such as zinc stearate are the easiest to clean and are the least detrimental to paint adhesion. Wax- and oil-type mold releases are not water-soluble. In a spray washer, they require higher-temperature cleaning with a solvent-aided cleaner. Silicone- or fluoropolymer-type release agents should never be used with plastics that are to be painted.

Some plastics have a built-in mold release. SMC, sheet molding compound, is a polyester resin reinforced with glass that is popular in the automotive industry. It usually contains a soap-based material to aid release. RIM, reaction-injection-molded polyurethane, sometimes contains an internal mold release (IMR). With appropriate cleaners, IMR RIM is easily cleaned. However, after cleaning, residual IMR in the plastic can migrate to the surface in an excessively heated dry-off oven.

This will cause problems with painting. To avoid this, keep the surface temperature of the part in the washer dry-off below the surface temperature of the post cure heating used in the molding process.

**Cleaning Equipment.** With today's growing volume of painted plastic parts, conveyerized spray washers are the most common and environmentally acceptable method of cleaning. Hand wipe cleaning is used on parts too large for some washers and on low-volume production parts.

A minimum of three washer stages is necessary, but more is preferred. The washer must clean in Stage 1, rinse in Stage 2, and rinse with deionized water in Stage 3. Other stages that are helpful are a rinse before the cleaning stage to clean off particulates such as sanding dust and plastic flashing splinters, and a second rinse stage following the cleaning stage to allow the use of a water conditioning chemical.

At the end of the washer should be an air blow-off followed by a drying oven. An adequate and thorough air blow-off prevents water spotting.

**Cleaning Chemicals.** Two major objectives of chemicals used for cleaning plastic are to remove common soils, including mold release, and to minimize water spotting. Proprietary cleaners do this to various degrees. To help minimize water spotting, a water conditioning chemical can be used in one of the tap water rinses. Sometimes a combination of chemistries in cleaning products will meet these objectives.

**Controlling the Cleaning System.** For consistent results with minimum paint defects due to poor cleaning, it is important to maintain constant control of the cleaning system. Chemical concentrations should be checked by titration at least twice a shift and additions of chemicals should be made immediately as needed.

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For high-volume production, concentration checks should be made hourly. When hourly additions are normal, an automatic chemical concentration controller and pump feeder can be used.

Tap water rinses should be overflowed at a rate that turns over the whole volume in the rinse tank every eight hours of production. It is extremely important to constantly monitor the quality of the deionized rinse water. The fresh deionized water feeding the final rinses should be a maximum of 15 micromhos per centimeter. This is important because most water spotting problems are due to a poor-quality final deionized water rinse.

Daily checks should be made for the cleanliness of washer filter screens and for any clogged nozzles. In cleaning molded plastic parts, nozzles readily clog due to plastic flashing splinters. The normal spray pressure for good cleaning is 25 psi.

**Continuing Challenges.** These are the optimum pretreatment and cleaning processes for painting the plastics we know today. These processes have changed in the last five years with changes in plastics, mold releases and paint finishes. The industry will continue to develop better cleaners and pretreatment chemicals in order to be ready for the new plastics, mold releases and finishes. **PF**

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