Hands-on Management

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Powder Coating: It Just Keeps Growing & Growing

Powder coating had its earliest practical beginnings in Europe in the late 1960s. In North America, powder coating really started to catch on in the late 1970s and early 1980s. In both cases, the initial usage was strongly encouraged by "Clean Air" laws. The growth of powder coating applications was nothing short of incredible. Powder coating grew at a combined rate of more than 20 percent annually. During this time, the tremendous growth can be attributed to the fact that powder coating was being used as a direct replacement for liquid paints over steel.

In 1996, North America used 206 million lb of powder coating materials, up 3.9 percent over the previous year. The breakdowns of usage (% by industry) are as follows:

%	Industry
17.3	Appliances
15.3	Automotive
6.8	Lawn & garden
4.3	Agricultural
56.3	General metal finishing/other

Methods of Application

Powder coating materials may be applied by flame spray and fluidized bed (may be electrostatic). The most common application method (99 percent) uses the spray gun. The application gun needs a steady and uniform flow of the powder (the term for this is fluidization). This characteristic depends primarily on average particle size and the range of particle size distribution. Most finishes use particles having a mean size of about 35–40 microns.

Materials

Powder coating materials can be first classified into two families: Thermoplastic and thermosetting.

Thermoplastic Resins

Thermoplastic resins are based on polymers that, when heated to their melting point, flow to form a smooth, unbroken coating. The film forming process is a melt-and-flow physical reaction. During the melt, no chemical reactions (cross-linking) take place. Powder thermoplastics consist of polypropylene, polyethylene, nylon and polyvinyl chloride (PVC). Most thermoplastic materials require a primer to give adhesion to the base metal. The typical primer used is a liquid epoxy. Applications for these materials exist in some interesting markets. Nylon (50 μm) on gears will substantially outlast hardened steel. Reagent acid glass bottles are coated with a thermoplastic to provide protection against breakage. These resins were the early players in the powder coating game, and are not as significant as are the thermosetting resins.

Thermosetting Resins

Thermosetting resin systems will undergo a chemical reaction (cross-linking to form higher molecular weight polymers) when they are heated. Once the polymers are heat-cured and the chemical change is complete, the melting point is much higher. The melting point may now be higher than the ignition temperature on the material. Primers are generally not needed because thermosetting resins have excellent adhesion to metal. This property makes thermosetting resins well suited for one-coat systems. Powder thermosetting resins consist of epoxies, polyesters and acrylics. Each basic resin type has its own unique properties. But, with the development of the hybrid resin coating systems (hybrids rule!) the traditional separations by chemical grouping are no longer significant.

The breakdowns of the percentage of usage of the different chemical types for year 1996 are:

%	Chemical Type
17.7	Epoxies
32.5	Epoxy-polyester hybrids
20.0	Polyester w/carboxyl functional group
25.3	Polyester w/hydroxyl functional group
4.5	Acrylics/other

Quality

The powder coating process generally produces substantially fewer rejects than the liquid coating process, because powder doesn't run and drip the way liquid paints do. When a problem occurs, the powder can simply be blown off the part and run back through the system. Even if the powder has been cured, parts can often be re-coated without rework, reducing labor requirements and scrap part generation.

Developments

Over the last four years, powder coating has seen new materials created to solve specific substrate problems. Brass faucets and other bathroom hardware maintain their color better as a result of the lower temperature/UV cures of the new clear coats. Aluminum wheel finishes are much more resistant to filiform corrosion (looks like worm tracks), thanks to new product developments. We have clearer topcoats for automotive finishes. Brand new are metallic powders with a look close to chrome.

Powder coating: It just keeps growing and growing!

Acknowledgement

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