Measuring Manufacturing Moisture

Hello Joe,

Is moisture an important measurement in the manufacturing of powders used in coating? If so, how is water measured? Also, does water affect polyurethane powder coating curing mechanism?

Geoffrey B.

Hi Geoff,

(You don't mind if I call you Geoff?) Believe it or not, powder coatings can tolerate a fair amount of moisture—up to 0.5% or more. Completely dry powders in a very low humidity environment (< 15% RH) exhibit electrostatic charging problems. Think of the charge picked up by dragging your feet (with socks) across carpeting on a very dry day in a cold winter. Excess static charge abounds. So a little bit of moisture is better than none.

High levels of moisture (>1.0%), however, cause clumping issues and poor fluidization. These phenomena create handling and application problems.

As for moisture interfering with cure in an isocyanate cured polyester powder, this is not an issue because there is negligible free NCO available because a blocking agent is present.

Joe Powder

Degassing Discussion

Hey Joe,

I’m looking for a degassing agent for low temperature cure powder coating.

Ahmet Ö.

Dear Ahmet,

I may need more information to answer your query. Degassing agents can be used for a variety of phenomena. Some “gassing” is related to the expulsion of interstitial air between powder particles as they fuse and form a film. In addition some cure chemistries emit volatiles; for example, e-cap blocked polyurethanes, glycoluril crosslinked polyesters and hydroxyl-alkyl amide (e.g., Primid®) cured polyesters. Also, a small amount of moisture (< 0.5%) is normally present in powders. Degassing agents are essential in all these scenarios. Another gassing phenomenon involves the expulsion of gases (air, water vapor, and even hydrogen) that are associated with substrates—cast metals, galvanizing, etc. This is commonly referred to as “off-gassing” or “outgassing.” A different set of degassing agents work for these phenomena.

Formulating for degassing is tricky business. Benzoin works very well for gas release in standard bake powder coatings. This pertains to the air, moisture and cure chemistry volatiles degasification phenomena. It doesn’t work so well in low bake (< 130°C bake powders) because its melt point is around 132°C and is rendered ineffective below that temperature. Hence, you need to consider more specialized proprietary products from additives suppliers (check out Estron, Troy Corp. and BYK Additives).

As for “off-gassing” or “outgassing,” the secret sauce is based on a wax. These waxes allow the coating to stay soft and “open” curing the melt and cure cycle. This open phase allows the volatiles from the substrate to evolve through the coating. After volatiles have exited the coating the wax refloows to fill the void created by the evolution. Specific product suggestions are available from Micropowders, Estron and BYK Additives.

I hope that this explains some of the magic of powder formulating.

Joe Powder

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Ironing Out the Alternatives

Dear Joe,

We powder coat in-house and have a five-stage washer of which one stage is a phosphoric acid bath. Do we have to have iron phosphate to get good adhesion? Is there an alternative process for iron phosphating? Thanks!

Ken

Dear Ken,

There are a number of alternatives to a five-stage iron phosphate. What you choose as your cleaning/pre-treatment process largely depends on a few issues.

1. The type of metal(s) that you coat.
2. The condition of the metal substrates (i.e., dirt, oils, oxides, etc.)
3. The specification and expectation of coating performance (i.e., adhesion and corrosion resistance).

The first step in preparing a substrate for powder coating is to clean any foreign materials and compounds from the surface. This can be accomplished by mechanical means (e.g., abrasion, blasting, tumbling), chemical means (e.g., alkalis, solvents or soaps) or physical means (e.g., flame, plasma, corona).

Mechanical means can work very well if the substrate is relatively clean to begin with and if you use an epoxy based powder. As you probably know, epoxies are great for hardness, corrosion and chemical resistance but do not fare well in outdoor environments (UV degradation). However epoxy or hybrid (epoxy-polyester) powders can provide very good indoor performance with only a clean, abraded or blasted surface.

If the coating requirement involves any resistance to outdoor elements you need, at the minimum, to clean thoroughly, rinse and apply a chemical conversion compound to establish a bond between the powder coating and the metal substrate. This will provide a minimum of outdoor durability for resistance to corrosion and attack by moisture.

If the coating will find service in a more demanding environment (i.e., coastal areas, northern states where salt is used on roads, marine, etc.) then a minimum of a five stage iron phosphate or better yet a multi-stage zinc phosphate pretreatment system. These have a long history of performance and are offered by many chemical companies.

If you wish to avoid using phosphate type pretreatment systems due to handling or regulatory issues, then you can consider a few other options. Recently non-phosphate systems based on zirconium, titanates and/or organo-silanes have replaced iron and zinc phosphate systems. These new systems require close process control and usually have to be tailored to the substrates and substrate conditions at the finishing line. All the major chemical companies have versions of these. I can provide a list of them if you wish.

Another option is to consider using a one-step pretreatment. One company in particular, Carpenter Chemicals, has a technology that was developed in Italy that has demonstrated success as a single-stage pretreatment. This technology is known as Plaforization™ and involves an organo phosphate (not phosphoric acid) that is claimed to provide cleaning and metal pretreatment in one step.

Regarding physical cleaning methods such as plasma, flame and corona these are most commonly used to clean and activate plastic surfaces rather than metal substrates. Plasma has an intriguing performance profile but is restricted to relatively small substrates or low volume when used as a pretreatment process.

I hope this helps. Please let me know if you need more information.

Joe Powder

Topcoat Topic

Joe,

Have you come across hydrophobic additives for powder coating? Or a wet paint that could easily be applied over powder coating for added protection?

Chris M.

Hi Chris,

Regarding a topcoat for powder coatings you may want to consider a scratch-resistant UV clearcoat. This technology is what is applied to polycarbonate eyeglass lenses. I realize that you seek a hydrophobic surface and these are touted to be scratch resistant, however the scratch resistance is developed with silicone and silane chemistry which is also quite hydrophobic. You can get more of an idea if you Google: optically-clear-hard-coatings.

Alternately, you can ask a powder supplier for a highly water-resistant powder coating. We formulators can develop hydrophobicity through high crosslink density and also with the incorporation of silicone additives.

Joe Powder

Joe Powder is our technical editor, Kevin Biller. Please send your questions and comments to Joe Powder at askjoepowder@yahoo.com.

Editor's Note: Letters to and responses from Joe Powder have been edited for space and style.

Not Your Average Joe...

Each issue, we take the padlock off the PCI® Test-Lab door for a few minutes so our favorite technical editor and “powder guru” Joe Powder can run in the yard. When he’s not gnawing on a rawhide bone, he loves to answer readers’ questions. Go ahead and send him one at askjoepowder@yahoo.com... he doesn’t bite. Maybe it’ll end up in the next issue!