Ask the Experts

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Your questions answered by PCI member experts.

You have questions, we have answers. In each issue of PCT, *our extensive network of powder coating experts provides information to help you with your powder coating challenges. Let us know what's keeping you awake at night, and we'll do our best to help you get a good night's sleep!*

Performance Validation

My company is looking to move away from our standard zinc phosphate pretreatment process to an advanced pretreatment process such as zirconium based. Our paint system consists of a powder topcoat. What can I expect from a corrosion performance standpoint, if we make the move from Zn to Zr?

Great to hear that you are exploring converting zinc phosphate to one of the advanced pretreatment products. There are many advantages to doing so. Today's advanced pretreatment (zirconium) chemistries provide good performance results that equal or nearly equal the performance of zinc phosphate. There have been numerous tests performed to compare the two pretreatment chemistries with the goal of achieving 1,000 hours of neutral salt spray. In one example, the zinc pretreatment and advanced pretreatment used duplicate substrate panels and were coated with the same powder. The average ASTM D1654 rating for the zinc phosphate process came in at 8.8, and for the advanced pretreatment process alternative was 8.4. The passing performance requirement rating for this test was 7. A similar study yielded results with an advanced pretreatment process with e-coat alone averaging an ATSM D1654 rating of 7.8 and with powder topcoat 10.0.

The testing shows that from a performance standpoint, both pretreatment chemistries are considered equivalent. It is always suggested that you meet with your chemical supplier and discuss your specific requirements and substrates. They can also help you through converting both the required chemistry and equipment.

Bringing the Heat

I am very interested in powder coating wood and wood products; however, all I have is a normal convection, batch-style oven. I wonder if this type of oven even works for coating wood or if I need to get an infrared conveyor oven. Any input you have would be greatly appreciated.

With the new ultralow melt and cure coatings used for wood substrates, a typical convection oven alone will not work well, nor will a batch/manual style system, as the process needs more control. The most important aspect is heating the powder up to a melt/flow point quickly. You might be able to do small parts in a batch system but would not be able to rack many due to the time constraints needed between the process steps. For a typical wood powder coating process, follow these suggested steps: one minute of infrared (IR) preheat to bring moisture to the surface of the board; powder application within 2-4 minutes of preheating; 5-7 minutes of IR cure (it is possible to have 2-4 minutes of IR and then hold the temperature with convection heat, but this is not the most efficient approach); 15-20 minutes of cool down.

Airing it Out

I was researching what the proper airflow in a powder booth should be. I have seen recommendations of 40-60 feet per minute air flow rate all the way to 150 feet per minute. Which value is correct? What will meet the regulatory requirements?

It can be confusing. The 40-60 feet per minute (FPM) air flow rate is the recommended air velocity in the spray zone. The spray zone is defined as the region in the booth where the coater is spraying the part. When it comes to containment air velocity, OSHA recommends a minimum containment velocity in powder booths be 100 FPM. In this case, containment velocity is defined as incoming air velocities through all openings in the powder booth. Most quality booth manufacturers use a containment velocity of 100-150 FPM. There are many variables that need to be considered before making the design decision. OSHA states the following in 1926.66(b)(5)(i): *The spraying operations except electrostatic spraying operations shall be so designed, installed, and maintained that the average air velocity over the open face of the*

booth (or booth cross section during spraying operations) shall be not less than 100 linear feet per minute. Electrostatic spraying operations may be conducted with an air velocity over the open face of the booth of not less than 60 linear feet per minute, or more, depending on the volume of the finishing material being applied and its flammability and explosion characteristics.

A Concrete Answer

An employee read that it can be helpful to place a steel plate between our ovens and the floor to help reduce heat loss. Our batch ovens sit directly on the concrete. Can you provide a little more information? Any insight you can provide will be greatly appreciated.

Adding something like a steel plate to the floor will not necessarily reduce the heat loss on its own, as the heat will be transferred over time when the oven remains on. Energy loss could be reduced, however, by placing insulation between a steel plate and the concrete. The heat loss reduction will depend on the type of insulation and thickness. However, there are other benefits to installing a plate as it will keep the concrete from breaking down and spalling due to the oven temperature and generating dirt in the oven.

Mother Nature

We have noticed differences in the quality of our powder coating on our products from winter to summer. We apply the same brand of powder at the same thickness but seem to have different results. Our facility is located in the southwest United States. What might be the cause of this and what can be done to correct it?

If your powder coating application including film build thickness, powder gun settings, etc., is consistent throughout the year, then it is recommended that you check the moisture content in the powder booth. If you do not have your booth located in an environmental room, then the natural humidity level variations from winter to summer—or for that matter, from morning to afternoon—can impact the quality of the coating. Mother Nature loves to be in equilibrium so any water that is in the powder booth from either high humidity or from incomplete drying of the water on the parts after the washer can be evaporated and then absorbed by the powder. This can lead to defects or poor coating quality. It is recommended that the humidity be checked and recorded in the powder booth to determine if this might be the cause. The target should be 40 to 60 percent relative humidity. In order to mitigate humidity issues, you may need to consider installing an environmental room.

It is also a requirement to have clean, dry compressed air. You should regularly monitor the water traps in the compressed air piping system and drain as necessary. Typically, any water introduced via the compressed air system results in large craters in the finish. It may be worthwhile to have an air compressor company do a complete audit of the air system to make sure everything is functioning correctly or to see if any changes need to be incorporated.

Distinguishing Characteristics

My company is in the process of reviewing all of our quality standards and requirements. When we started to review powder coating, none of us were sure that we fully understood the possible characteristics that can be utilized. What would you consider a complete list of powder coating characteristics that we can use? We may not need to use them all, but we think we should at least take a look at them.

There are numerous powder coating characteristics. They generally fall into three categories: surface appearance, physical properties, and environmental durability. The chart below shows the various characteristics along with their test procedures and test equipment needed.

Surface Attributes	Test Procedures	Test Equipment
Smoothness	PCI Technical Brief #20	PCI smoothness standards
Gloss	ASTM D523	Glossmeter
Color	ASTM D2224	Colorimeter
Distinctness of image	ASTM D5767	Visual observation or meter
Contrast ratio	PCI #3 or ASTM D2805	Special substrates, reflectance instruments

Physical Attributes	Test Procedures	Test Equipment
Film thickness	ASTM D7901; D1400; D7378-16	Magnetic thickness gauge or eddy current thickness gauge
Impact	ASTM D2794	Impact tester
Flexibility	ASTM D522	Conical or cylindrical mandrel
Adhesion	ASTM D2197-16; D3359	Balance-beam scrape adhesion, cross hatch device, and tape
Pencil hardness	ASTM D3363	Standardized leads or pencils
Abrasion resistance	ASTM D4060; D968	Taber abrader and abrasive wheels and falling sand
Edge coverage	ASTM D2967-07	Standard substrate and micrometer
Chip resistance	ASTM D3170M-14	Gravelometer
Pre-cure powder thickness	ASTM D7378-16	Ultrasonic thickness gauge

Environmental Durability	Test Procedures	Test Equipment
Solvent resistance	PCI Test #8; ASTM D5402	Swab and MEK or other solvents
Stain resistance	ASTM D1308	Standard reagents
Chemical resistance		Immersion or spot tests
Humidity	ASTM D1735 or D2447	Standard water fog chamber, test chamber, 100% RH @100 degrees Fahrenheit
Salt spray	ASTM B117	Salt fog chamber
Weathering	PCI #9; ASTM D1014; D4141: D5031; D822; D4587; D3361; G23; G26; or G53;	Panel racks, special racks with reflectors, weatherometer, QUV, and other equipment

Have a question for our powder coating experts? Send it to asktheexperts@powdercoating.org.