Ask the Experts sponsored by Gema

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!*

Getting Fired Up

We are planning to upgrade our powder coating line in the near future and are currently evaluating several options—including full electric vs. hybrid ovens and 3-stage vs. 5-stage pretreatment systems. We're seeking guidance to help us determine the best solution for our specific application. Could you recommend any relevant resources (e.g., technical publications, case studies, expert blogs, or industry professionals/companies) that could support our decision-making process?

When comparing natural gas and electric convection ovens, the primary difference lies in the heat source—air circulation and curing performance should remain essentially the same. The key factors in your evaluation will be the differences in capital investment and long-term operating costs.

If you're considering an electric infrared (IR) oven versus a natural gas convection oven, it's essential to first conduct curing tests using your specific parts. These tests will help determine whether IR can effectively reach and cure all areas of the parts and establish the appropriate IR oven size and shape for your application. We recommend contacting an IR oven manufacturer to arrange a trial and gather data.

As for choosing between a 3-stage and 5-stage pretreatment washer, your first step should be consulting with a pretreatment chemical supplier. They can help assess your corrosion resistance requirements, which will typically dictate the number of stages needed and the type of conversion coating best suited for your process.

For further information and guidance, we suggest the following resources:

1. **PCI's *Powder Coating: The Complete Finisher's Handbook:*** This comprehensive resource includes detailed information on pretreatment processes, chemical options, and oven technologies (including gas and IR systems). You can purchase it on the PCI website, www.powdercoating.org.
2. **PCI Webinars:** PCI offers over 40 free webinars covering a wide range of topics. Several sessions focus specifically on pretreatment chemistry, infrared ovens, and system design. You can access the webinar library on the PCI website.

The Daily Grind

We are replacing an existing powder booth with a new quick color change cyclone booth. The proposal includes a powder coating sieve. Is this something that is required? What does it do?

Powder coating sieve systems serve two key functions: removing contaminants from recovered powder and conditioning fresh powder before it reaches the spray guns. Recovered powder contamination typically falls into two categories. The first includes airborne dust and dirt introduced during operation or from external sources such as hooks, conveyors, or maintenance. The second includes impact-fused powder chunks that form inside venturi assemblies, hoses, and guns, then break loose and mix with recovered powder.

Sieve systems work by passing the recovered powder through a screen before it returns to the supply hopper. Fine, usable powder passes through the mesh, while contaminants are retained and discarded. Screen mesh size affects both the separation quality and the amount of powder processed—larger openings allow higher throughput but may miss finer contaminants.

Fresh powder may also require conditioning before use. Shipping and storage can cause compaction or moisture absorption, negatively impacting fluidization and sprayability. Sieving fresh powder before its first use breaks up lumps, separates particles, and restores proper flow characteristics—leading to improved application efficiency and product quality.

While sieve systems are widely recommended, they are not always necessary. The decision depends on the finish requirements of the coated product. For example, a dust speck may be acceptable on a black coating over a rough surface but unacceptable on a white Class A finish. Though an initial

investment, sieve systems can deliver significant returns in quality and process stability. This consideration should ideally be addressed during system design, but most modern systems allow for cost-effective retrofitting if needed later.

Dust in the Wind

I am the new safety director for my company and have been asked to update our old safety program. One area I believe we are missing or have incomplete information on is on our health and safety issues related to powder coating, specifically concerning powder handling and exposure requirements. Would you please provide me with some information I might use in my safety manual.

Powder coatings consist of resins, curing agents, pigments, and various additives. While most of these materials are not classified as hazardous, they are still considered airborne particulates in the workplace and must be handled accordingly. Both the American Conference of Governmental Industrial Hygienists (ACGIH) and the Occupational Safety and Health Administration (OSHA) regulate worker exposure to "Particulates Not Otherwise Classified." The ACGIH recommends an 8-hour time-weighted average exposure limit of 10 mg/m^3 for total inhalable particulates. Consult your material safety data sheet (MSDS) for the specific powder being used to identify any unique hazards and review proper handling procedures.

Maintaining exposure below this threshold is typically straightforward and does not require significant expense. However, powder particles can be mildly abrasive and may cause irritation to the skin, eyes, or respiratory system upon contact. As a result, workers should wear basic personal protective equipment (PPE), including eye protection, OSHA-approved dust masks, and protective clothing that covers exposed skin. In certain situations, such as when handling specific formulations, additional protection like face shields, respirators, or chemical-resistant gloves may be necessary. Cleanup should be done with vacuum systems rather than compressed air to minimize airborne dust and reduce irritation.

In addition to exposure concerns, powder coatings pose potential combustion and explosion risks under specific conditions. If powder accumulates in a confined space or forms a dust cloud, it can ignite upon contact with a flame, spark, static discharge, or hot surface. Fine particles are especially prone to combustion. Explosions may occur inside equipment such as mixers or dust collectors and can trigger secondary explosions if surrounding dust becomes airborne.

To prevent such incidents, it is critical to:

- Eliminate sources of ignition by following the National Fire Protection Association NFPA 33 standard.
- Keep dust concentrations below the lower explosive limit (LEL).
- Use spark detection systems on automated equipment.

For an added safety margin, avoid activities like welding or grinding near powder areas, and ensure dust does not accumulate on electrical components, which can lead to overheating and ignition. Good housekeeping practices not only enhance worker safety but also contribute to better coating results and lower reject rates.

By following proper handling, housekeeping, and ventilation practices, manufacturers can minimize risks and maintain a safe, efficient powder coating operation.

Shutter at the Thought

May I please have your opinion as to whether or not the cause of the blistering in this image of powder coated aluminum shutters is likely due to poor or defective pretreatment?

Yes, blistering, adhesion loss, and delamination on aluminum shutters can be and is often related to poor or defective pretreatment. Here are some aspects of the pretreatment process you should verify:

- Cleaning: Ensure the aluminum surface is free of oils, dirt, and oxides. Any contamination can prevent proper coating adhesion.
- Etching: If you are etching the substrate, verify that it is effectively removing the oxide layer and creating a suitable profile/etch-rate for adhesion.
- Rinsing: Poor rinsing after etching can leave residues that interfere with adhesion. Check water quality (deionized or clean tap water) and ensure thorough rinsing.
- Conversion Coating: If you're using a chromate or non-chrome conversion coating, confirm that it is properly applied (coating weights, etc.) and fully dried. This layer significantly improves adhesion and corrosion performance.
- Drying: Ensure parts are completely dry before powder coating. Trapped moisture can lead to adhesion failure and blistering.

Although this is likely caused by the pretreatment or substrate preparation process, also consider checking the following to validate your process:

- Curing: Verify that the powder coating is reaching the required temperature and time profile for proper crosslinking to occur. Under cured powder can cause delamination from the substrate.
- Coating Thickness: Too thick of a coating can cause adhesion issues. Measure and confirm that the applied thickness is within specifications.

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