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*To get the color right, a pigment manufacturer expands its curing capabilities*

When a powder that is white in the lab comes out yellowish on a finishing line, an aluminum pigment manufacturer embarks on a problem-solving odyssey that reveals a fundamental difference between cure ovens.

## Case History

If you've ever had to repaint a room and you just wanted to keep it simple and paint it white, this seemingly basic coating solution can quickly become alarmingly complex and nuanced. Do you want glossy, semi-gloss, flat, or satin? And the endless color cards and rows of color chips claiming to be white, range from a yellowy ivory to a pristine marshmallow hue and everything in between depending on the pigment cocktail. After shaking the can and putting the first coat on the wall, does the color still look like the chip you based your selection on?

Color is crucial to coatings. Color consistency poses a challenge to finishers who need to make high-volume production runs that have little or no variance. What happens when a manufacturer specifies a metallic powder coating and it yellows? A complex problem-solving process ensues that leaves the end user, the powder manufacturer, and the pigment supplier scrutinizing each others' processes and searching for the elusive cause that ultimately leads to a discovery that burns with obviousness only to one with the omnipotence that comes with hindsight—the color variation manifests itself in the cure cycle of the end user who uses a gas-powered oven compared with the pigment maker who tests the powder coating in an electric-powered oven.

Benda-Lutz produces aluminum pigments for coatings industries, including printing inks, plastics, liquid coatings, and powder coatings. The company manufactures with its proprietary Blitz bonding process at its 60,000 square foot plant in Independence, KY. This process adheres effect pigment to the powder coatings resin. The plant has a color development lab and a quality control (QC) lab that are dedicated to new development.

## Color matching to customers' standards

Typically, a powder coatings manufacturer sends a standard—it may be dry-blended or bonded-that it wants Benda—Lutz to color match for a part or a panel incorporating the effect pigment. Pigments range from 2 to 3 microns to 70 microns, depending on the finish effect the customer is looking for. Employees in the color lab achieve a color match by using 5 pounds of base supplied by the manufacturer, selecting the pigment based upon the end use, and matching the color chip or standard. Finally, technicians run the color-matched powder coatings through the bonding process and return the finished product sample. "A lot of our work is the high-end bonded work, which may be either in the automotive or office furniture industries as well as architectural," said Adam Andreas, vice president of technology.

Generally, lab technicians begin by applying a small sample of the powder onto stainless steel panels to ensure the color is on target. Next, Benda-Lutz generates a small test sample (300 pounds) that the customer can run on its line without anyone investing too much on the first batch. After this approval, production ramps up to batches as large as 90,000 pounds. From these batches, lab technicians pull out samples from every ninth box and spray the powder onto customer-recommended panels including those from ACT Test Panels, Hillsdale, MI.

The bonding process produces a consistent metallic effect and finish uniformity within each production batch and from batch to batch. In addition, the powder with bonded metallic pigments allows end users to reclaim the powder. Compare dryblended pigments that tend to give high separation because metallic and effect pigments tend to carry a different charge than the powder, and can settle out and away from the base powder, yielding sporadic results on the parts. “When we adhere the pigment to the base powder, it’s going to have a more uniform charge and ease of application,” Andreas said. “There isn’t any edge buildup of the pigment or sparking from the gun, and you achieve a uniform appearance from box one to the end of your run in production, from lab sample to last part.”

### Getting different results with the same powder

Despite these advantages, the finish sometimes gets lost in translation from Benda-Lutz’s lab to the end user’s finishing line. The lab includes application equipment and originally electric-powered cure ovens to align its test application with the intended end use. However, color variations sometimes emerged. For example, Benda-Lutz prepared a powder coating for a powder supplier whose customer finishes office furniture. After blending the pigment and testing the powder in its lab, the manufacturer sent this metallic powder to the powder supplier and end user who got a slightly more yellow, darker finish than the lab results. “One of the things we and the industry-at-large struggle with is site-to-site application differences,” Andreas said. “Despite lining up our application with whatever the customer’s application parameters are, we found in some instances we get different results. In this instance, the customer came back to us and said, ‘it wasn’t what we expected. It was more yellow.’” This degree of variance was unacceptable. To identify the cause of this discrepancy, Benda-Lutz launched a systematic probe into its and its customer’s coating processes. This application involved a large-volume metallic powder. Lab workers scrutinized the color and QC labs’ coating operations, including application parameters, such as spray patterns and kilovolt settings. Personnel also ensured that the substrate matched the end user’s part. In addition to this internal investigation, Benda-Lutz also examined the furniture manufacturer’s coating line and the powder formulator’s application capabilities. First, lab technicians brought the powder directly from the lab to its customer’s plant and had the manufacturer’s employees spray it on with their equipment. The color variance persisted. Next, technicians brought the lab application equipment and used it to apply powder at the office manufacturer’s line. Still, the metallic powder yellowed. “It was extremely frustrating,” Andreas said. “Some of the keys were after we did some internal tests, passing powder back and forth spraying out of the same bag, we got to the point where we did take our application equipment up to their site to eliminate operator variability. We sprayed the powder both at our site and cured it in our electric oven, then took [our] equipment to their site, sprayed the same powder by the same operator, cured it in their gas oven, and we could see a difference.”

After this period of trial and error, technicians concluded that the color variation arose because of different cure ovens—Benda-Lutz used an electric-powered convection oven while the end user has a gas-powered convection oven. This trend became more pronounced when the company noted other large-volume coaters

who used gas-powered cure ovens also reporting color variations. To align itself with its customers, Benda-Lutz knew it had to have a gas-powered cure oven in its labs. “We want to have the most up-to-date technology for our process and what our customers are using,” Andreas said. “We need to change as our customers change. We were told by the president of one company in particular that we will always see these application differences until we buy a gas oven.”

## Curing the curing problem

Upon deciding to add a gas-fired oven to its lab, Benda-Lutz followed a recommendation from a powder manufacturer who has a strong presence in the office furniture industry and chose an oven from Precision Quincy, Woodstock, IL. “Our customer uses Precision Quincy and has always found it to provide a consistent cure that correlates to that of its powder applicators,” Andreas said. The customized batch cure oven features digital indicating temperature control, adjustable air circulation, prewired NEMA-1[1] control panel, NFPA 86[2] compliance, welded steel construction, structurally reinforced steel doors, and mineral wool insulation. Mini-Sentinel control and monitoring system serves as a trouble-shooting tool and includes nine first-out alarm indicators, four maintenance timers, and a built-in batch timer. This unit also controls exhaust and recirculation motors.

## Making a better match boosts efficiencies

As it continues to realize the full benefits of adding a gas-powered oven (the company continues to transfer some products over to the gas oven), Benda-Lutz has already realized some quantifiable rewards. The company has seen a reduction in reworks and rejected colors. In addition, the company has taken proactive steps to acknowledge the visual difference between curing in an electric-powered cure oven versus a gas-powered unit. When specifying a new job, the pigments supplier provides a request form that seeks detailed cure information including oven type. “Our rework on gas-cured products has dropped from about 7 percent to under 5 percent, which equates to an overall 30 percent reduction,” Andreas said. “This improvement in quality through a Quincy oven has even helped in getting faster approvals for colors using Benda-Lutz’s newest pigments for powder coatings, introduced this year.”

## End notes

*1. National Electrical Manufacturers Association. All NEMA 1 devices are two-wire non-grounding devices rated for 125 V maximum. See [www.nema.org].*

*2. National Fire Protection Association. NFPA 86 is the standard for ovens and furnaces. See [www.nfpa.org].*

Gas-powered convection cure oven:
**Precision Quincy, Woodstock, IL**
**815/338-2675.**
**www.precisionquincy.com**

Test panels:
**ACT Test Panels, Hillsdale, MI**
**517/439-1485.**
**www.acttestpanels.com**