



PRODUCTION
AND TECHNOLOGY

Chemical muesli



Powder coatings are more than just granulate that has been milled and sifted. The expertise that goes into making these products is clear upon visiting the Renningen plant, where Wörlag has been mixing, dispersing, extruding, and granulating since 1996.

By Jo Berlien Photos by Florian Imberger

Our visit to the plant begins in an unexpectedly simple way. The Renningen site does not have a reception. If you have an appointment, you ring the bell on the shift director's door. The powder-coating production facility does not get visitors very often. The people who run it wear white coats rather than white shirts. But they get up to rather colorful business, to judge by the product range. With 75 employees and three shifts a day, the plant currently produces up to 180 tons of powder coatings a week, or around 7,500 tons a year, in as many as 3,700 versions with different compositions, shades, and volumes.

The best place to view the action is from plant director Stefan Gerboth's office, which has large windows and is located in the middle of the production hall. Gerboth (51) looks out onto extruders, breakers, sifters, and 25-kilogram boxes containing the freshly ground powder products. His gaze sweeps out over the hall at regular intervals. Everything is running the way it should.

Gerboth, who comes from the Westphalian city of Hamm in the Ruhr Valley, first trained as a chemical technician and then studied process engineering at the Berg- und Hüttenschule Clausthal-Zellerfeld. He has specialized in powder coatings for a quarter of a century, and also spent many years working internationally with a major competitor in the same sector. One of his projects during that period was to modernize and expand a factory's infrastructure and machinery. In 2012 he assumed overall responsibility for powder-coating production for Wörwag. Gerboth loves these coatings. He would probably not put it that way, but his enthusiasm is evident in his voice.

One reason for this certainly has to do with their special properties. Powder coatings are tough customers. They can take all manner of punishment and still look great. They are resistant to impact, scratch, and abrasion. They don't fade in any weather, and are easy to work. This makes them well suited for asphalt shredders and other construction and agricultural machines. The blue seat backs on ICE trains and the red brake calipers on the Porsche 911 are also powder-coated.

Yet another advantage lies in the fact that they take relatively little time and energy to be applied. If powder-on-powder coatings are used, no curing is needed in between. Primer, top coat, and off to the oven – all in one step. Wörwag's powder coatings won the Surface award in gold from the Fraunhofer Institute for Manufacturing Engineering and Automation (IPA) in both 2012 and 2016. This all-round talent among coating systems is also a good choice for household applications. Joannis Miggos, who has worked in quality assurance at Wörwag for 34 years, has a powder-coated refrigerator in his kitchen. "I can tell everyone that I helped make it," he says with evident satisfaction.

But how are powder coatings made? Mills are needed. The Renningen site has ten of them. But mills alone are not enough.



Colorful view: Stefan Gerboth, head of powder-coating production, watches over the action from his office.

Wörwag produces vertically, i.e. from the top down in a four-story structure. Its 28-meter high-bay warehouse can hold 3,100 pallets. Unmanned forklifts convey the raw materials to level four, which is where the mixers are filled. The smallest has a volume of 30 kilograms, the largest a good three tons. There are also horizontal production facilities, but they require larger surface areas. Vertical designs save space.

But their one disadvantage is the drop height. The raw granulate plummets down the pipelines. If you put coarse and fine-grained materials into the funnel at random, says Head of Quality ▶



It's all in the mix: Jakob Bayer fills a mixer with granulate to launch the production process.



Small but smart: Sergej Wiebe with a special mixer for exclusive coatings.

Powder coatings are tough customers. They can take all manner of punishment and still look great.

Assurance Gabi Martini, the larger pieces will lie on top and the smaller pieces will trickle to the bottom – like what happens with muesli. So the ingredients are weighed not only to meet a formula, but also a specified sequence. Coarse material first, then fine, then coarse again to clean the pipeline. The mixer subsequently runs for six to twelve minutes, and a one-kilo sample is checked by the quality controllers. “The raw mix has to meet all the quality requirements,” says Gerboth. “Because after extruding and milling there’s very little you can change.” If the controllers find any deviations, adjustments are made.

The chemical muesli consists primarily of polyester and epoxy resins, or a mixture thereof known as a hybrid. These binders form the paint film that holds all the solid particles, and also determine appearance, hardness, curing, and stability. They are joined by pigments, fillers, and additives of different granulate size and density. Black, white, and colored pigments produce the specific shade. Fillers ensure volume, support the mechanics, and make the product matt if desired. Additives influence the consistency,

gloss, hardness, and UV resistance of the surface. Because powder coatings don’t have solvents, no liquids are needed. The pigments, fillers, and additives are dispersed, which means distributed uniformly throughout the resin and thereby wetted, as explained by the chemical dictionary.

The next step is extrusion. In mechanical engineering, extrusion consists of pressing viscous substances such as thermoplastic materials through dies to produce molded forms. The extruder, or “hot meat grinder” as Gerboth puts it, melts the raw granulate mix at 135 to 145 degrees Celsius. The dough-like mass is dispersed, kneaded, and compressed by twin-screw rollers, cooled as part of a calender-rolling process, and broken up into hard, brittle chips.

Then it’s time for milling. A sifter in the mill separates the stock by particle size, density, or inertia. The speed of the rotary disk adjusts to the respective granulate sizes of chip batches. The mills can granulate fifteen to a thousand kilograms of stock per hour. A ventilator sucks the powder out of the mill through a cyclone separator onto a flat-bed screen whose 85 to 140-millimeter mesh catches coarse or flyover granulate and any non-milled stock before the powder flows into packaging for shipment and sales: 20 or 25-kilogram cartons, bulk bags that hold up to 700 kilograms, or steel containers that hold up to 350 kilograms, depending on what the customer orders.

Ignazio Senis, who gives final approval to the powder coatings, was recently in a furniture shop in Stuttgart where he bent down to inspect a designer piece by the Swiss company USM. Its glossy surface had also come from Wörwag – a powder coating from Renningen. When the sales clerk walked up, Senis simply commented, “Great work!” ■



In good form: the mixed granulate is extruded, rolled out, and broken up into chips.

Mission accomplished: quality controller Joannis Miggos uses color panels to compare the order and the result.

How do powder coatings get to the customer?

