Shelley Verdun, PPG Industries' Business Manager for Industrial Coatings, outlines what recent developments in low-bake powder coatings mean for modern industrial finishing

Innovations in powder offer opportunities for wood products

Recent advancements in powder coatings for temperature sensitive substrates have created new opportunities for manufacturers of cabinetry, furniture and other wood-related products to improve the durability of their goods, create premium-looking finishes and incorporate more sustainable solutions into their processes.

EVOLUTION OF POWDER COATINGS

Since it first emerged as a dry finishing process in the early 1940s, powder coatings have undergone evolutionary improvements in application, performance and design capabilities. Today, it is one of the fastest growing coating technologies in the world, fuelled in part by increasing demand in the Asia Pacific region.

Several factors are converging to drive the rapid adoption of powder. Global interest in more sustainable solutions, rising demand for special effect finishes and, most recently, the development of fast-cure, low-bake technologies top the list.

Powder coatings have been widely used in metal finishing for more than half a century. But unlike metals, wood cannot be exposed to the high temperatures required for curing most powder coatings. Other challenges for powder application on wood-based substrates include low conductivity, poor dimensional stability and inconsistency in moisture content and substrate quality.

But advancements in application, curing, resin and binder chemistries have produced formulations that eliminate these traditional barriers with baking temperatures as low as 250-350°F (121-177°C) and cure times at five minutes or less.

With porous substrates like wood, the preheating process encourages outgassing and brings moisture to the surface to increase conductivity. The coating is then electrostatically applied using an automated spraying system, and parts are once again heated at low temperatures for quick curing in a convection oven, an IR oven or a combination of both.

These developments are proving to be game-changers for manufacturers of furniture, cabinetry, casegoods and shelving, RVs, building products and other industries that rely heavily on heat-sensitive wood and wood-based substrates like MDF, HDF, oriented strand board, plywood and hardwoods such as birch, maple and bamboo.

AN EDGE OVER LAMINATES

Laminated products are popular options for high-traffic, heavy-use spaces like dorms, recreational vehicle interiors and offices. While they can be more affordable than solid wood pieces and are engineered to withstand wear and tear, laminated products do have some notable drawbacks.

Edge-banding tapes and strips attached with hot melt glue or adhesives are widely used to protect unfinished and exposed edges. Unfortunately, chipping, peeling and moisture damage at seams and corners are common and repairs can be difficult or next to impossible.

By replacing laminated products with powder coat finishes, makers of furniture and other wood-related goods eliminate edge-banding and their vulnerabilities. With proper application and curing, these low-bake powder coatings can extend the life and looks of products by fully encapsulating them to guard against ultra-violet radiation, marring, abrasions and harmful effects of moisture. In addition, powder coatings can be touched up or repaired on site if damaged.

Another significant advantage is that low-cure formulations like PPG ENVIROCRON®

HEATSENSE powder can be formulated with antimicrobial protected additives that release silver* ions, protecting the cured paint film from spreading microbes and bacteria to the environment.
This technology is available with PPG ENVIROCRON® SILVERSAN antimicrobial** protected powder coating.

GREATER DESIGN FLEXIBILITY & SPECIAL EFFECTS

The advantages of these innovative powders go beyond robust protection and durability.

In 2022, consumers are increasingly interested in premium-looking finishes and curvilinear shapes, two areas where powder coatings excel. Powder offers greater design flexibility than competing technologies by providing smooth and textured finishes, along with wrinkles, hammer tones and special effects through a sublimation process that can mimic marble, stone and granite, at a fraction of the cost of the genuine materials. Manufacturers can also customise finishes with elements ranging from routing and curved edges (easier to create without edge-banding) to ingraining a name or picture of logo into the product.

Low-cure powders are available in a wide range of RAL and customised colours like metallics and matte to high-gloss finishes.

MORE SUSTAINABLE SOLUTIONS

Leading global efforts to reduce hazardous waste and volatile organic compound (VOC) emissions, particularly in China, are also contributing to powder's growth.

While powder coatings are specifically formulated without VOCs, they can also be reclaimed and resprayed and require only compressed air for clean-up, so no hazardous waste is produced during the entire finishing process.

Overall, powder coatings have a lower carbon footprint than solvent-based stains, paints and laminates because less energy is used in finishing process. Low-cure powders require even less with lower baking temperatures and faster cure times than standard powders.

ASIA PACIFIC POISED TO DRIVE LOW-TEMPERATURE SOLUTIONS

Two factors are expected to drive the rapid adoption of low-cure powders in the Asia Pacific region.

First, China and India are the world's largest consumers of powder coating technologies, driven by rigorous efforts to reduce air pollutants by requiring that

manufacturers use lower VOC paints and coatings.

Second, the sheer size of the wood products market in Asia represents significant opportunities. Globally, the market is expected to reach US$684bn in 2022, with the Asia Pacific region accounting for nearly half as the largest wood products market in the world.

INCREASED OUTPUT AND LOWER PRODUCTION COSTS

Not only do low-bake coatings cure at lower temperatures, they also cure in less time, which can improve productivity since more parts per shift can be finished—and often with less labour.

Powder coatings can also reduce material costs since they have a higher transfer efficiency rate (most powders are 80% or higher) compared to competing technologies, so less product is needed for a durable, protective finish.

PPG EMERGES AS TOP LOW-CURE POWDER PROVIDER

A global leader in powder innovations, PPG capitalised on emerging demand for temperature-sensitive solutions with the 2020 acquisition of Alpha Coating Technologies, a pioneer in low-bake powders. The company launched PPG Envirocron HeatSense powder in November of that year.

Used in a one- or two-coat process, this next-generation powder coating can be applied uniformly over heat-sensitive substrates and accommodates the shrinking and swelling of wood over the product's lifetime.

PPG Envirocron HeatSense powder fully encapsulates the substrate with a smooth, durable finish, provides a moisture barrier and allows freedom of design not usually possible with laminated coatings. While PPG Envirocron HeatSense coating is ideal for wood and wood-composites, it can be used on a multitude of substrates:

- Hardwood
- Medium-density fibreboard (MDF)
- High-density fibreboard (HDF)
- Oriented strand board (OSB)
- Plywood
- Particle board
- Fibreglass
- Heavy-gauge steel
- Composite concrete board
- Wood siding

QUICK OVERVIEW OF THE POWDER COATING PROCESS

Curing preheat

- Preheat substrate
- Temperature range 150-250°F (66-121°C)
- Dwell time from 1.5-10min
- Substrate dimensions and type dictate exact conditions

Powder application

- Standard powder spray guns
- Film thickness of 85µm or more, enough to form a continuous film
- Film thickness uniformity has to be controlled

Powder cure

- Temperature range 250-350°F (121-177°C) in IR or convection oven
- Dwell time 5-10min
- Substrate dimension and type dictate conditions

A LEGACY IN WOOD PROTECTION AND BEAUTY

PPG Envirocron HeatSense powder is a more recent addition to PPG's coatings portfolio, but the company's legacy in wood coatings spans more than a century with solutions for every step of the wood finishing process, including toners, primers, stains, fillers, sealers, glazes and topcoats.

PPG's comprehensive family of wood coatings solutions is backed by a state-of-the-art R&D wood coatings lab, leadership in colour and unmatched technical expertise. ■

*Silver is a registered pesticide with the U.S. Environmental Protection Agency (EPA), ranging from insects and animals and weeds to micro-organisms such as fungi, bacteria and viruses.

**Antimicrobial is limited to the treated surface to provide mould and mildew resistance on the paint film and to inhibit the growth of stain and odour-causing bacteria that may affect the surface of the coating. The use of these products does not protect users of any such treated article or others against food-borne or disease-causing bacteria, viruses, germs or other disease-causing organisms.

Author: Shelley Verdun is PPG's Business Manager for Industrial Coatings. She has been a part of the coatings team for more than 34 years and has helped to lead the company's growth as a coatings leader across the world.