

Further Development of Dry Blend Systems

Mat Powder Coatings for New Applications

Since the introduction of pure polyester powder coatings, matting has been one of the major challenges faced by powder coating manufacturers. Following detailed research, a new generation of dry blend systems that meet a wide range of differing customer requirements has now been launched.

A dry blend is a mix of two powder coatings. The polyester resins in each coating have very different acid values, which leads to significant differences in reactivity between the two components. This causes a microstructure to form on the surface of the coating that scatters the light and produces a mat effect. The main benefit of this type of system is that a gloss level of between 15 and 40 units can be created reproducibly. In addition, dry blend systems are resistant to weathering and overbake.

Dry blend products have been available for decades and, despite intensive research, it has so far not been possible to find any equivalent alternatives. In recent years, coating manufacturers have attempted to use special curing agents to produce a deliberate incompatibility with the polyester binder. Until now, they have only managed to develop dull mat coatings with acrylate curing agents. The key disadvantage of these systems, in addition to their restricted mechanical properties and relatively high price, is their poor gloss stability with different extrusion parameters and at different curing temperatures. Another option available is to set the gloss level by mixing two polyester resins with very different acid values. The problem here lies in the high proportion of curing agent (β -hydroxyalkyl amide), which results in excessive dehydration (polycondensation reaction). The high reactivity leads to poor flow and a lower threshold for the formation of orange peel.

Using waxes and fillers to produce a matting effect allows a gloss level of around 45 units to be achieved (angle of measurement 60°). Because waxes migrate to the surface during the curing process, high concentrations cause a milky, cloudy finish, which is particularly obvious on dark-coloured coatings. There is still no alternative to dry blend systems for producing matting in the range of 15 to 40 gloss units.

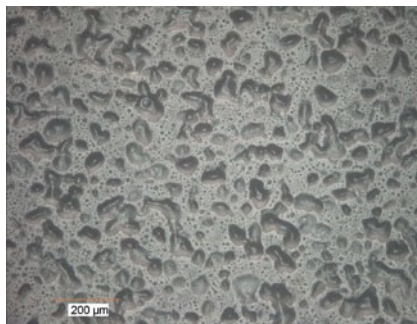


Figure 1: Microscope image of the microstructure of dry blend powder coatings.



Figure 2: The sparkling effect of new dry blend powder coatings (right) is significantly reduced in comparison with standard systems (left).

For these reasons, the powder manufacturer FreiLacke began further developing its dry blend products with the aim of improving the flow, the sparkling effect, the gloss consistency and the mechanical properties, as well as reducing the curing temperature to 160°C . In addition, FreiLacke wanted to improve the reflectance of white powder coatings to increase their light efficiency.

FreiLacke's research produced successful results. The company has developed five new product ranges that can be used both indoors and outdoors. The weather resistance of systems 1 to 4 complies with the GSB standard quality level (300 hour QUV B test, residual gloss $\geq 50\%$).

New standard system for general industry applications

The first system is cured for 10 minutes at an object temperature of 180°C . It can be used to coat ceiling panels, storage systems, door frames and industrial trucks, for example. It has a significantly better flow at thicknesses of 60 to $140\ \mu\text{m}$ than many conventional products and the sparkling effect is also considerably reduced.

In addition, system 1 has excellent gloss consistency at different thicknesses (Figure 3) and different curing temperatures (Figure 4).

High level of flexibility during subsequent forming processes

System 2 is also cured for 10 minutes at an object temperature of 180°C . It combines the positive features of system 1

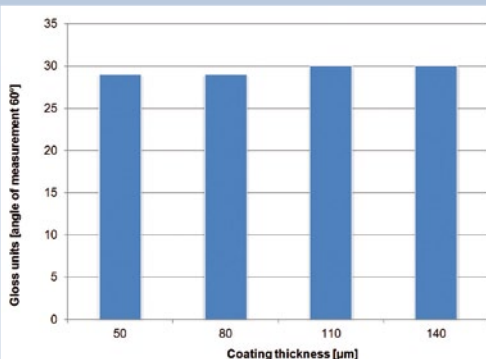


Figure 3: Gloss consistency in layers of different thicknesses.

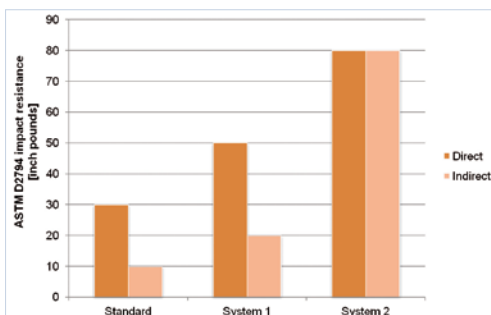


Figure 5: System 2 has even better mechanical properties than system 1. The coating on steel sheet is 80 µm thick and it is cured for 10 minutes at an object temperature of 180°C.

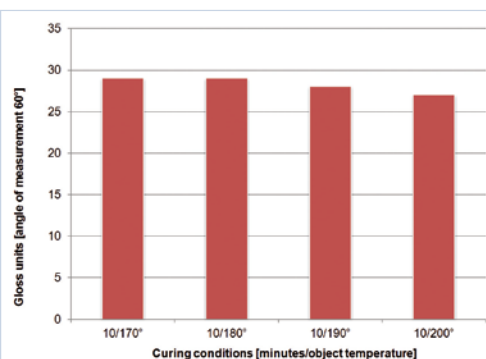


Figure 4: Gloss consistency at different curing temperatures.

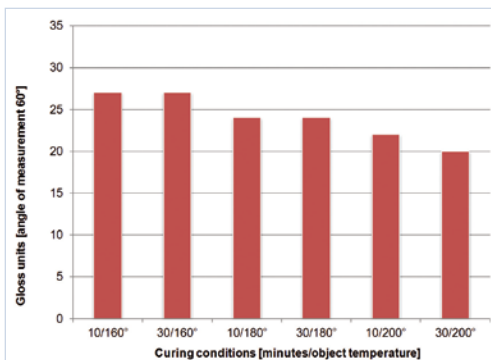


Figure 6: Gloss level following different types of curing.

with considerably better mechanical properties (Figure 5).

Improved reflectance

System 3, a powder coating with improved reflectance in an untinted shade of white, is also cured for 10 minutes at an object temperature of 180°C. Powder coatings of this type are generally used on light fittings where a high light output ratio is needed. Other applications include ceiling and wall panels that will lighten up rooms and allow the number of light fittings or the output of the bulbs to be reduced.

This product, which is already on the market, currently has the highest possible level of reflectance that can be produced using a powder coating. As well as good flow and a reduced sparkling effect, this system also offers excellent gloss stability and overbake resistance (30 minutes at an object temperature of 200 °C → DE* ≤ 0.5).

Energy-efficient low-bake powder coating

System 4 is cured for 10 minutes at an object temperature of 160 °C. As oil and gas prices rise, the demands placed on energy-efficient powder coatings are changing. The goal is no longer simply to save energy, but also to increase productivity by shorten-

ing the oven cycle time. Where a wide variety of different parts is being coated, powder coatings with low curing temperatures enable the peak oven temperature to be reduced while ensuring that the solid parts are properly cured and the thin-walled parts are not overbaked. In order to allow the system to be used for many different applications, the gloss consistency must be guaranteed over a wide temperature range from 160 to 200°C (Figure 6). The appearance of the coating and its mechanical properties are the same as those of the new standard system.

Highly flexible super durable powder coating

System 5 was developed to meet the increasingly high standards imposed on construction and agricultural machinery (it is cured for 10 minutes at an object temperature of 180 °C). For a super durable powder coating, the system has very good mechanical properties. The weather resistance of the system complies with the GSB master quality level (600 hour QUV B test, residual gloss ≥ 50%) (Figure 7).

Summary

Following comprehensive research, new dry blend systems have been developed to meet a broad range of different customer requirements. Freilacke's extensive expertise in formulating powder coatings and knowledge of the raw materials that can be used to produce specific properties will allow further individual modifications to be made in future. ■

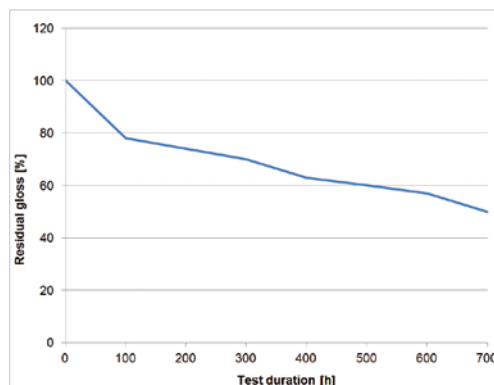


Figure 7: The QUV B test demonstrates that the super durable powder coating complies with the weathering requirements of the GSB master quality level.

Alexander Schelling

Emil Frei GmbH & Co. KG,
Bräunlingen, Germany,
Tel. +49 (0)7707 151 502,
a.schelling@freilacke.de,
www.freilacke.de