New Two-Component, Polyurethane, Ultra-High-Solid, Single-Coat System

For High-Quality Applications

A new two-component, ultra-high-solid, single-coat system meets all the requirements of high-quality applications. In addition, the new coating system reduces production and logistics costs.

The demands placed on coating systems are constantly increasing in terms of both the quality of the surface finish and the efficiency of the coating process. Another factor for consideration is the VOC regulations, which have led to the growing use of environmentally friendly water-borne paints, powder coatings and high-solid systems. Many users need coating systems with a solid content of around 80 % by weight in order to ensure that their solution falls well below the VOC threshold of 420 g/l. Systems of this kind are described as ultra-high-solid systems.

High-quality industrial coatings have typically taken the form of multi-layer structures consisting of two-component epoxy primers, together with two-component polyurethane top coats. This type of system produces coatings with excellent adhesion and corrosion resistance properties, a high-quality surface finish and resistance to UV light and chemicals.

The disadvantages of these processes include the use of several different paint systems and the additional time needed to apply, ventilate and dry the coatings, all of which lead to high coating costs.

A single-coat system with the properties of a multi-layer solution

The single-coat systems which have been commercially available in the past have had problems involving the processing cycle times and the thickness of the dry coating that could be produced. There were limitations on their use on shot- or sand-blasted substrates and on components with a more complex shape. The coatings manufacturer Freilacke has now developed a two-component, single-layer system with a solid content of 80 % by weight using the latest generation of raw materials. The system meets the requirements for high-quality coatings, can be applied in a thick layer without blistering, dries easily and offers good surface properties. Its corrosion resistance levels correspond with those of the multi-layer structures described above. The VOC content of the coating system is well below the regulatory threshold.

Short cycle times

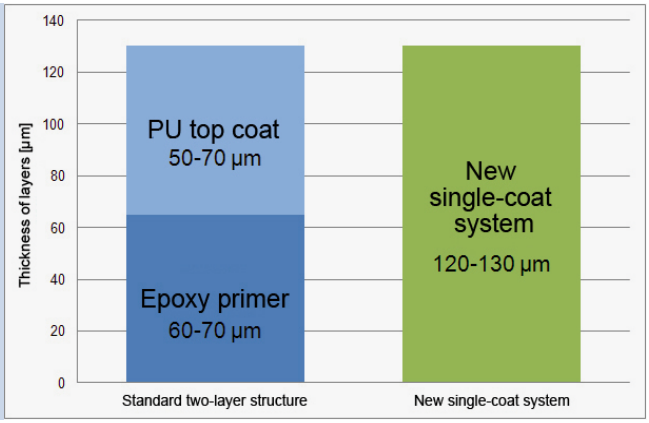
In contrast to conventional multi-layer coatings, the new coating system can be applied at its full thickness in one operation. As this dispenses with the need for an interim flash-off period and an accelerated drying process for the primer, the cycle times can be shortened significantly. In addition, it reduces the amount of solvents used, in particular for cleaning purposes.

The use of the new single-layer coating not only increases throughput, but also means that only one application system is needed. Reducing the number of coats to one also makes handling, logistics and storage of the coating materials much simpler. In addition, there is no risk of the two different coatings being confused during the application process. The benefits of the significantly increased solid content of the new coating system with regard to VOC emissions are shown in the table. The overall emissions per coated area show a reduction in VOCs of around one third with the use of the new single-coat system.

Accelerated or room-temperature drying

The ideal conditions for applying the coating are within a temperature range of 18 to 25 °C and within a relative humidity range of 40 to 70 %. The air-mix procedure is the ideal application method for the new system, but it can also be applied using conventional air atomisation processes. The coating can be dried both at room temperature and in an oven at temperatures up to 80 °C without problems.

Particularly beneficial features of the new system are its resistance to sagging and low risk of blistering. The new single-layer coating will begin to sag from a dry coat thickness of around 130 µm, whereas with a standard top coat system the figure is approximately 90 µm. Both systems can be used to produce coatings with a thickness of 150 µm without blistering. The good flow properties and the high blistering limit of the single-coat system are clearly



Comparison of a traditional two-layer structure with the new single-coat system (Standard two-layer structure PU top coat Epoxy primer New single-coat system)

demonstrated in particular by the high gloss levels and low haze figures resulting from airmix application.

Despite the fact that the solid content of the single-coat system is significantly higher than that of a high-gloss top coat, there is only a minor difference in the resulting surface gloss, which is obvious from the high quality of the coated surfaces.

System	Dry coating thickness [µm]	Solid content [w/v]	VOC [g/l]	VOC [g/m²]	VOC total [g/m²]
New single-coat system	130	80	335	70	70
Conventional two-layer system					
Standard primer	70	69	440	63	106
Standard top coat	60	69	395	43	

Comparison of the total VOC figures for the new single-coat system and the conventional two-layer structure.

Shorter drying times

Even disregarding the interim flash-off period for the primer before the application of the top coat, the single-layer product dries significantly faster than two-layer systems and produces a coating of an equivalent thickness. The considerable reduction in the drying time for the single-coat system allows the coated components to move on to further processing much more quickly. The coating is touch-dry after a flash-off/drying time of eight to ten hours at room temperature or after an accelerated drying process of 45 minutes at 70 °C. The pot life of the product is 90 minutes, which represents a good balance between its drying properties and its processing time.

High levels of corrosion resistance

The following substrate pre-treatments are recommended for the one-layer coating in order to provide the best possible corrosion resistance: zinc phosphating, shot-blasted or galvanised steel, aluminium and electrocoat primers. Tests show that in particular on shot-blasted steel and on aluminium the corrosion resistance is very high and corresponds to that of standard multi-layer coatings.

Resistance to conventional chemicals

Neither of the two types of coatings (single- or multi-layer) showed any signs of delamination, blistering or rust formation after 600 hours exposure in a condensation test. The Weather-O-Meter (WOM) test of weather resistance produced residual gloss values of 85 % at a measurement angle of 60° with the RAL 1012 shade of lemon yellow following 1000 hours exposure. With a Delta E figure of around 0.75, the colour difference was significantly below visual tolerances. The coating also has a good level of resistance to a variety of conventional working materials and chemicals.

In conclusion, the results show that the new single-coat system meets all the requirements for high-quality industrial coatings. The system therefore represents an energy-efficient and cost-effective alternative to the coating processes currently available on the market.

Dr. Roland Kern
Group Manager Development Industrial Coatings,
Emil Frei GmbH & Co. KG, Bräunlingen, Germany,
Tel. +49 7707 151 283, r.kern@freilacke.de, www.freilacke.de