

COATING OF LIGHT ALLOY WHEELS

Conversion to water-thinnable coatings

Water-thinnable basecoats and clear coatings are just as well suited to the coating of light alloy wheels as conventional solvent-based coating systems. As a wheel manufacturer and a coatings manufacturer have recently been able to demonstrate in a cooperation project, converting an old system is a substantially less costly and resource-intensive process than changing a system over to powder-based clear coatings.

For several years now, water-thinnable metallic basecoats have been increasingly used for coating light alloy wheels. In combination with powder primers and acrylic powder clear coatings, a very effective reduction in organic solvents can be achieved with water-

thinnable basecoats. New systems are predominantly designed for the use of this coating structure.

In old systems, which are generally operated with priming powder and solvent-based liquid basecoats and clear coatings in the wet-in-wet process, the

conversion to acrylic powder clear coatings is frequently not possible at all or only at considerable financial expense. The reason: The priming powders used are only very poorly compatible with the new acrylic powder clear coatings. The priming and acrylic powder coating

The lines are flushed in the following steps prior to using water-thinnable base coating:

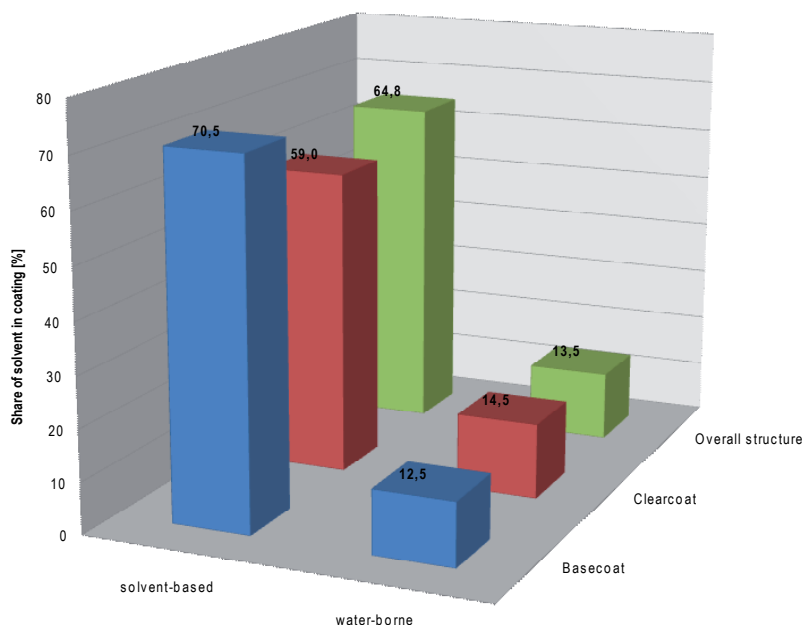
- First flushing with the cleaning solvent used in production
- Intermediate flushing with a water-thinnable solvent (glycol ether)
- Post-flushing with deionised water

The change back to solvent-based coating was carried out in reverse order.

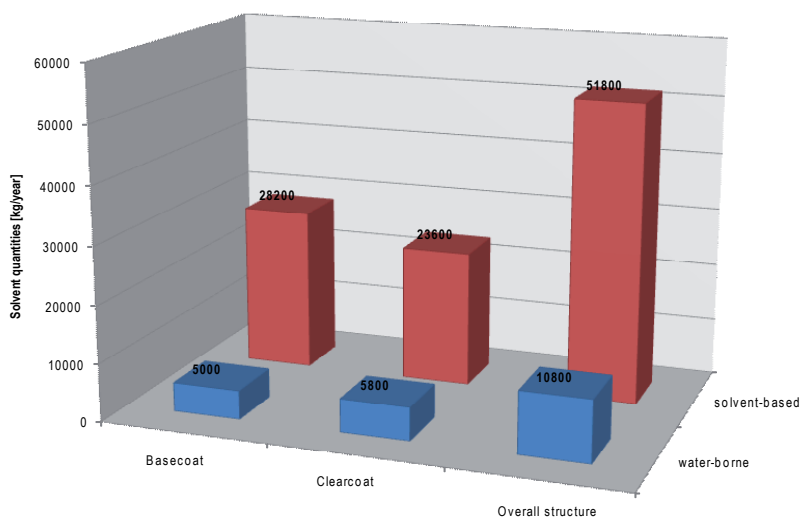
◀ A multi-stage rinsing process was carried out to completely clean the supply lines before changing the coating

The results of the corrosion test confirm the high quality of the Freiotherm-Hydro-Clearcoat WO1868GRA999 when applied to light alloy wheels. The values originate from tests on the overall structure of the wheels. ▼

Type of Test	Duration of Loading	Test Standard	Test Results
Cross cutting (2 mm)		ISO 2409	Gt 0
Multiple stone chipping test		PSA D24 1312	Characteristic value 1; no impacts down to base
CASS-Test	240 hours	DIN EN ISO 9227-CASS	No bubbles, creepage at cut 1 mm, cross cutting Gt 0
Salt-spray test	1,000 hours	PSA D17 1058	No bubbles, no edge corrosion, creepage at cut 1 mm
Water immersion	504 hours	PSA D27 1327	No bubbles, no change of colour, no matting effects, cross cutting Gt 0
WOM-test (Florida)	1,600 hours	VW PV 3930	Colour change dE = 0.22; loss of gloss angle 20° -2%
WOM-test (Kalahari)	1,500 hours	VW PV 3929	Colour change dE = 0.34; loss of gloss angle 20° -5%
Chemical test		PSA D27 5144	Ethanol, super petrol, diesel, gear oil, xylol → no change



By using aqueous base and clear coatings in the converted coating system, the percentage of solvent used is considerably reduced. The share drops from 64.8 to 13.5 percent in the overall structure.



The annual solvent consumption is considerably reduced to almost one-fifth thanks to the use of the new coating system

been offered on the market as an alternative, which can be applied in a controlled process under the given conditions.

Conversion to a water-thinnable coating system

In cooperation with a wheel manufacturer, the firm Emil Frei has succeeded in solving this problem. Working as a team, the old system was converted to a purely water-thinnable coating system. The initial coating situation was as follows: Up until the end of 2007 approximately 40 tonnes of solvent-based basecoats and 40 tonnes of clear coatings were applied annually at the customer's plant. The coatings were carried out with four electrostatic automatic guns in each case. The flash-off time between the application of the basecoat and the clear coating was just under 10 minutes at temperatures around 30 °C.

The temperatures of the wheel surfaces fluctuate between 30 and 50 °C. During the conversion of the old system, two alternatives resulted for the customer. These were either conversion to acrylic powder coating involving high investment costs, or the conversion to a water-thinnable clear coating preferred by the customer due to the lower financial outlay required.

Same brilliance and gloss values

The first challenge was to offer a basecoat, which shows no adverse effects on the colour tone, brilliance and gloss in the wet-in-wet process – both in combination with hydro-clearcoat and for a transitional period in combination with conventional clear coatings. With hydro-clearcoats, a major challenge lies in achieving a high Kocher limit and a high application security with reference to the stability and gloss. It was already possible to achieve good durability in the development process with some binder systems after a short time. On the other hand, it was a demanding task to achieve high application security in the wet-in-wet process using water-thinnable basecoats.

booths must therefore be consistently spatially separated from each other. This is often not possible in the old systems, which usually have a very compact design. The conversion of the systems from solvent-based liquid clear coatings to acrylic powder clear coatings is correspondingly expensive and quickly

results in investment costs of up to 300,000 euros. The dilemma lies in the fact that the VOC requirements often cannot be met with water-thinnable metallic basecoats alone if solvent-based clear coatings are also still to be used. However, on the other hand, until now no water-thinnable clear coatings have

Preliminary tests on site

To make the decision easier, preliminary tests were conducted on the existing system with both possible variants, i.e. with water-thinnable clear coating and powder clear coating. As this was to take place at a modest expense, the tests were conducted in some cases under rather improvised conditions. The delivery containers of the basecoat were installed with provisional insulation. As the coating lines were insulated to some degree, it was possible to conduct the first tests with a reduced voltage setting and without additional modifications.

The first tests with hydro-clearcoats were conducted in the clear coating booth with a cup gun. The same procedure was used for coating with acrylic powder coating.

It already became clear during the first tests that the hydro-clearcoat variant was so promising that the acrylic powder variant was initially discontinued. The conversion of the basecoat booth was finally carried out after the first sample wheels coated with solvent-based clear coating or with hydro-clearcoat had been internally accepted and subjected to initial corrosion tests with regard to the colour tone and effect development. During conversion lines were replaced and insulated, and an isolating system was installed. Following a larger series production test, sample wheels with a structure of hydro-basecoat and solvent-based clear coating were submitted to the customer for approval. After the approval had been granted, the metallic basecoat was then replaced with the water-thinnable system in a first step. Then the firm continued to work with the solvent-based clear coating used previously for another nine months.

Close cooperation with final customer

During this time the first system tests and approval tests were conducted with the hydro-clearcoat. The sequence of the

tests was for the most part the same as the procedure used for the basecoat. After the customer had in turn given its approval, it was finally possible to begin with the conversion.

During the summer break in 2008 a line conversion – with new insulated coating lines and electrical isolation – was carried out. Following the conversion, production was then resumed using the water-thinnable clear coating. Thanks to the intensive preliminary testing conducted, the conversion functioned problem-free and to the customer's complete satisfaction from the outset. Production has now run properly for approximately four months.

Thanks to the solvents saved, the converted system meets the environmental protection requirements, and in particular the requirements of the VOC Ordinance. With the decision in favour of a water-thinnable clear coating instead of an acrylic powder clear coating, it was also possible to considerably reduce investment costs.

New development of matt hydro-clearcoat

As a new development in the hydro-clearcoat segment, a renowned wheel manufacturer recently began using a matt clear coating, as matt acrylic powder coatings were not available in the required transparency in the past. It is used here for so-called gloss-turned wheels. In this process the visible surface (star) is turned down to the metal following powder priming and coating with basecoat. Then it is first coated over a glossy acrylic powder finish and then with a matt hydro-clearcoat in an additional step. In this case the degree of gloss is 20 to 30 gloss units 60° angle).

Use in the normal three-layer process (priming powder – basecoat – matt clear coating) is also possible here, as the properties of the matt clear coating are equivalent to those of the glossy hydro-clearcoat.

Low-cost system conversion

The use of water-thinnable basecoats and clear coatings for coating light alloy wheels is a technically feasible, technologically equivalent alternative to solvent-based coating systems. Conversion of older systems for processing water-thinnable systems can usually be realised with a considerably smaller investment than required for conversion to powder clear coatings. The condition for a successful conversion is always the close cooperation between the owner, the system manufacturer and the coating producer. The willingness to conduct intensive preliminary tests on the corresponding coating system is an important condition for a smooth production launch, as not all influencing factors of a coating system can be simulated in the laboratory or in applications engineering.

—|

The authors:

Herwig Brietzke (Liquid Coatings)
and Ralf Widmaier
(Water-Borne Coatings/Wheel Coatings),
Emil Frei GmbH & Co. KG,
Bräunlingen, Tel. 07707 151-0,
h.brietzke@freilacke.de, r.widmaier@freilacke.de,
www.freilacke.de

Additional contact:

Jürgen Meyer, Automotive Industry Sales Manager,
Emil Frei GmbH & Co. KG,
Tel. 0151 171 17911, j.meyer@freilacke.de