

## POWDER COATINGS FOR MAXIMUM ABRASIVE STRESS

# Abrasion and Corrosion Resistance Aligned

Organic coatings used on shelves, office furniture, shop counters, workshop equipment or machine tools are subjected to extreme stresses by scouring, scratchy and abrasive loads. A new powder coating system proves much more resistant to these everyday stresses.

— The development of an innovative powder coating system enables coating manufacturer FreiLacke to offer powder coatings that can be developed specifically for the corresponding stresses.

Various surface effects can also be achieved. Extensive testing demonstrated the high abrasion resistance as compared with conventional coating systems.

## Improved sliding properties to stop scratching

Until now, coating systems designed to increase abrasion resistance have generally been devised as follows: surfactants, such as waxes, slip or flow-control additives, are used to improve the “apparent” surface hardness or surface slip. The surface activity thus results in an improvement in the slip properties, which promotes scratch resistance.

The disadvantage of this method is that, after a certain number of load cycles, surface activity decreases and the “body” of the coating systems is attacked on a massive scale.

In addition, until now, various types of mica have been used as fillers that, if present in sufficiently large quantities, also have a positive effect on the abrasion resistance. However, the disadvantage of this type of filler is that it can reduce long-term corrosion resistance. Users have called for this to be improved upon.

## Demand-led surface hardening

Together with the use of suitable substances that doubtlessly have a positive effect on surface properties, the selected resin matrix, combined with a suitable filler packing, could be tailored to make it much more resistant to abrasion.

In this way, it is possible to design specific products, as required, for different types of abrasion influences, such



Figure 1: Even cats' claws cannot leave their mark on the highly abrasion-resistant pow-

as rubber or sandpaper-like stresses. After a requirements analysis with the user, a customised product can be developed. First and foremost, the Taber-abraser test (as per DIN 53 754) is used to determine the abrasion properties. This involves subjecting the coating surfaces to various friction rollers and different loads.

In parallel with the development of this technology, various other forms of customer-specific stress testing are also performed. The application-based test equipment used generally consists of hydraulic or pneumatic displacement devices that push or pull a defined object over the coating surface.

The highly abrasion-resistant formula of the powder coatings can be used in various resin-hardener combinations. Highly abrasion-resistant powder coatings can thus also be formulated on either a hybrid or polyester basis. Various surface effects (smooth, structured) and gloss levels can also be achieved.

As an example for this article, a satin-matt hybrid powder coating and a glossy polyester powder coating were compared. In a Taber-abrasion test, a rubber-like stress (friction roller CS10) and an abrasive stress (sandpaper S33) were applied in order to analyse the coating surfaces.

Figure 3 shows the comparison of a standard formulation, namely a formulation used thus far to improve abrasion properties, and the highly abrasion-resistant formulation with friction roller CS10.

### Substantial increase in abrasion resistance

As a result of the chemical composition of the resin matrix (increased elasticity), a polyester powder coating is fundamentally more resistant to abrasion than a hybrid powder coating. A hybrid powder coating with a highly abrasion-resistant formula results in an improvement of more than 50 percent in abrasion resistance as compared with the standard formulation and, with polyester powder coating, the improvement is greater than 85 percent.



Figure 2: Significant difference after 300 load cycles – the standard powder coating (left) and the highly abrasion-resistant powder coating (right)

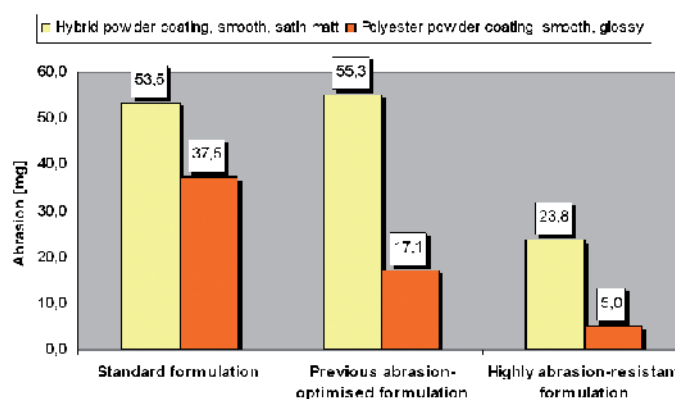


Figure 3: Comparison of abrasion resistance – result of the Taber-abraser test with rubber-like stress (friction roller CS10, 200 revolutions, load 500 g)

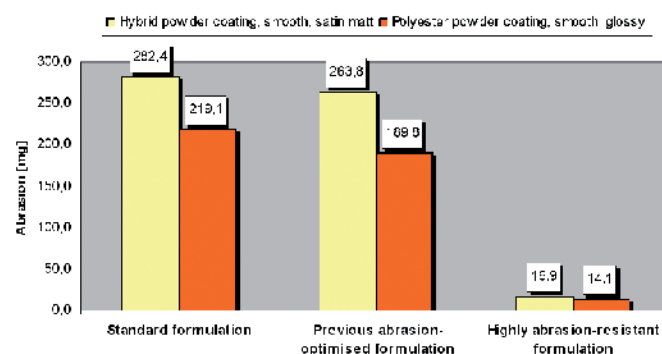


Figure 4: Comparison of abrasion resistance – result of the Taber-abraser test with abrasive stress (sandpaper S33, 200 revolutions, load 500 g)

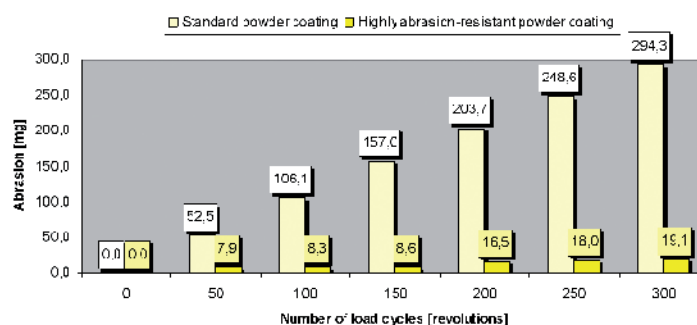


Figure 5: Abrasion depending on the number of load cycles (sandpaper S33, 200 revolutions, load 500 g)

Under these test conditions, with the technologies used thus far to improve abrasion resistance, either zero or only a slight improvement can be achieved. Similarly to Figure 3, Figure 4 illustrates the possibilities of highly abrasion-resistant powder coatings under scouring stress.

Under abrasive stress, the powder coatings behave in a similar manner to the first series of tests. However, the possible improvements are more significant. In the case of the polyester powder coating, it was possible to improve the abrasion resistance by almost 95 percent.

Figure 5 illustrates the Taber-abraser test with S33 sandpaper depending on the number of load cycles. In this case, a standard hybrid powder coating and a highly abrasion-resistant powder coating were compared on the same basis.

This series of tests illustrates that, without relevant preparation, standard powder coatings degrade almost linearly. Even after just 50 load cycles, highly abrasion-resistant powder coatings are much more robust; after 300 revolutions in the Taber-abraser test, there is an improvement of almost 95 percent.

The sandpaper was replaced after 150 revolutions and this resulted in a significant increase in abrasion in the highly abrasion-resistant formula and consequently a greater stress compared with the standard powder coatings.

A manufacturer of powder-coating application technology investigated the service life of the relevant conveying and application components. No adverse signs of abrasion or any unusual sintering were determined as a result of the highly abrasion-resistant powder coat-

ings as compared with standard powder coatings.

### Guaranteed corrosion resistance

The series of tests to investigate the mechanical properties and chemical or climatic stresses did not reveal any negative effects. In particular, no negative corrosion results have so far been established.

In further development stages, the results obtained to date will be transferred to metallic powder coatings.

Wherever resistance is required against scratches, abrasion or scouring, the highly abrasion-resistant powder coatings can offer significant added value. —

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