New Two-Component Cathodic Electrocoating System based on Acrylate

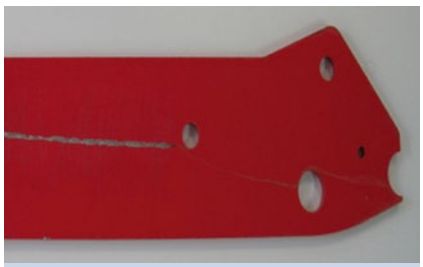
UV Protection and Corrosion Protection for Agricultural and Construction Machinery

When the search is on for cost reductions in the painting process, the first port of call is always the cost of the paint being used. However, the chances of achieving significant savings in this area are low. More money can be saved by reducing the thickness of the coating, but there are limits to what can be achieved in this area too.

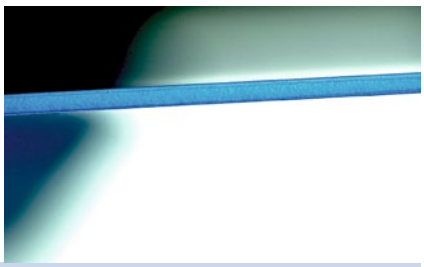
The new acrylate-based single-layer cathodic electrocoating system provides excellent UV protection for construction and agricultural machinery.

Opportunities are still available for improving the energy efficiency of all industrial coating systems, but the potential here is limited because of the chemical reactivities of the products. Another option is to shorten or even dispense altogether with individual parts of the process. In the field of industrial coatings, the subject of monolayers is currently arousing interest. One new electrocoating product is an e-coat acrylate dip system. This single-layer coating provides maximum UV protection together with effective resistance to corrosion. The general opinion on coatings of this kind is that the UV protection is effective, but the corrosion protection is far from adequate. But is this really the case? Similar discussions have also taken place on the subject of reducing the thickness of the coating. Initially the main concerns were that it would not be possible to protect substrates from corrosion if thinner coatings were used. In practice, the opposite has proved to be true.

At the same time, coating manufacturer FreiLacke is constantly asking the question as to whether a 1000-hour salt spray test is really needed or wheth-



Production component after a 504-hour salt spray test.



Left: Microscope image of a standard edge. Right: Microscope image of a coating with edge protection additive.

er 720 hours or "only" 504 hours would be sufficient. Of course, every user must be aware in advance of the requirements for the coating and of whether compromises are possible. There is naturally no need for discussion about the use of a single-coat cathodic electrocoating system based on acrylate if it is being compared with a two-coat system, consisting, for example, of an epoxy-based e-coat dip system and a powder coating. In this case, the single-coat system will never achieve comparable results in terms of corrosion resistance.

Despite this, FreiLacke has set itself the challenge of overcoming this problem. The company was already aware of the market requirements and specified the following objectives for its development work:

- The highest possible level of corrosion protection: The aim was to pass the 480-hour salt spray test at U < 1 mm on original parts. In the laboratory, the lower threshold was set at 720 hours.
- Edge coverage: A specially developed test method made the results easier to assess.
- Gloss level: The higher the better – a minimum of 70 GE at a 60° angle was the requirement. The gloss level is a very important factor in the agricultural machinery industry in particular.
- Levelling properties: A uniform, smooth surface is essential to achieve a high gloss level.
- One thousand hours in the WOM test was the goal.

The main focus during the development of the new two-component acrylate-based electrocoating system was on corrosion protection on edges. A single-layer e-coat dip system cannot be used on complex welds because of the resulting surface changes around the weld seam in the form of glass spots and smoke residues. This does not even take into consideration the laser cut edges, which are impossible for any type of coating to accommodate. In order to prepare the surface as effectively as possible, the parts must either be blasted or must undergo a separate pickling phase during the pre-treatment process. After blasting in particular, it is essential that the electrocoating adheres well to the peaks in the substrate caused by the blasting process and to the sharp-edged surfaces, in order to provide complete surface protection.

The accompanying requirements for the highest possible level of gloss and good levelling properties made the development process more difficult.

Testing a variety of pre-treatments

Alongside the development of the coating, tests were carried out with existing pre-treatments. The classic solutions, such as zinc phosphating, continued to provide the best corrosion protection. However, newer systems, such as conversion coatings containing no phosphate, also known as nanoceramics, produced very good results with the potential for further development.

Limits on external ion levels

The subject of the carry-over of external ions was also considered in detail. On the basis of its varied experience of existing electrocoating systems, FreiLacke attempted to reproduce the corresponding carry-over scenarios. The resulting contamination levels were specified as the maximum limits.

Different mixing ratios provide flexible solutions

After several months of testing, a modern two-component system was developed which meets the objectives listed above. The system can be used at different mixing ratios in order to meet varying requirements relating to colour, gloss level and substrate properties. The new system has now proved its effectiveness in two large plants in the agricultural machinery industry.

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