Protect your turbines

Words: Dipl.-Chem. Joachim Rother, Technical Director, novatic COATINGS Group

The novatic® COATINGS Group has an extensive portfolio of high quality coating materials, for industrial corrosion protection, for use in various industries.

There is a wide range of corrosion protection systems and applications available ranging from easy to use, for the protection of interior steel constructions, without additional demands, to high corrosion stress in maritime domains (C5M-high), as well as the protection of steel constructions within an industrial atmosphere (C5I-high), also with permanent exposure to moisture and for the chemical industry with its additional demands. Proven coating systems for the protection of the materials e.g. steel, spray- and hot galvanised steel, stainless steel, concrete and the like are available. This is why novatic® has been very successful over the past 20 years, in the wind energy sector and has numerous references.

In the middle of the 90s the first wind turbine steel towers (WTGS) were coated with a novatic® corrosion protection system. The importance of this market was already recognised at this time, so product development was purposefully encouraged. A team, composed of chemists and application technologists, successfully worked on applications on towers, drive engineering, gondolas, hubs and rotor blades. They developed a focus on the use of VOC-low coating materials, (coating materials with a low solvent content or solvent free) taking in to account the high technical demands from different specifications.

By extensive development work and in conjunction with corrosion short tests according to DIN EN ISO 12944-6, we successfully formulated a solvent free 2C-EP primer, which shows very good corrosion protection, based on special inhibitors combined with zinc phosphate. For the single layer and of course, especially when used with a top coat, excellent resistance was proven in salt spray tests – ISO 7253 with crack, condensed water tests – ISO 6270 and to chemical resistance tests. This newly developed primer assortment includes products ZG97 and ZG90 for steel constructions and product GK01 for concrete protection.

All of these solvent free, thixotropic coating materials may be applied flawlessly in high film thicknesses. Therefore, it is possible to reduce the common 3- or 4 layer systems to 2 layers, leading to reduced time and cost in production. Also in the high performance top coatings, novatic® has used the technically newer and more efficient (PASP) polyaspartic polymers, alongside the standard polyurethane materials. These polymers are already mentioned in the draft of the new ISO 12944 as alternative to the coating system tabs ISO 12944-5.

Due to the chemical curing reaction, the polyaspartic coatings ZD57 and ZD58 are 2C coating materials, low in solvent content, with short drying times, which can be applied flawlessly, up to an approx. wet film thickness of 300 µm. The materials are thixotropic and certainly applicable at this film thickness range. The quality is therefore greatly improved. The 2C-polyaspartic top coat materials are curing materials similar to the classical 2C-PUR- top coat materials with aliphatic polyisocyanates. These are characterised by excellent colour and weathering stability. The products ZD57 and ZD58 are available in different glosses, e.g. 20 GU up to 30 GU/60 °C, or depending on customer specifications, up to 70 GU.

Furthermore colour shades with long-lasting colour stability, necessary for air traffic control, are part of the range.

Here is an introduction to novatic® solutions for the most important fields of application:

Steel towers for On-Shore WTGS

The long protection period which is required for the lifetime of the WTGS, demands high performance systems according to DIN EN ISO 12944. The requirements for the corrosion category after DIN EN ISO 12944-2 start from C3 up to C5-M. These result in different protection systems: C3 for the inside area and C5-M for the outside, offshore and C5-I for industrial areas.

The protection systems with C4 classification are sufficient for wide landscape areas.

The novatic® protection-system's wide product portfolio offers diverse compositions of primers and top coats.

Therefore various coating systems are possible in regard to the coating materials and the dry film thickness. The choice of the coating materials and systems are subject to the specifications of the customer.

Here are a few examples, including dry film thickness due to different stresses and corrosion categories:

Interior area C3:	
2 Layer system (standard):	
1 x 2C-EP-Zinc dust primer, MG46	60 µm
1 x 2C-EP-Top Coat, ZG90 cream	140 µm
Total film thickness:	**200 µm**
Monolayer system:	
1 x 2C-EP-Monocoat ZG97 cream	160 µm

Exterior areas:	
3 Layer system for C4-high:	
1 x 2C-EP-Zinc dust primer, MG46	60 µm
1 x 2C-EP-Intermediate Coat, ZG75 EG HS	100 µm
1 x 2C-PUR-Top Coat ZD38	80 µm
Total film thickness:	**240 µm**
2 Layer system for C4-high:	
1 x 2C-EP-Primer EG HS, ZG97 DB702	140 µm
1 x 2C-PUR-Top Coat ZD38	60 µm
Total film thickness:	**200 µm**
3 Layer system for C5M-high:	
1 x 2C-EP-Zinc dust primer, MG46	60 µm
1 x 2C-EP-Primer EG HS, ZG97 DB702	180 µm
1 x 2C-PUR-Top Coat ZD57	80 µm
Total film thickness:	**320 µm**
2 Layer system for C5M-high:	
1 x 2C-EP-Primer EG, ZG97 DB702	200 µm
1 x 2C-PASP-Top Coat HS ZD57*	120 µm
Total film thickness:	**320 µm**
*PASP: 2C-Polyaspartic-Top Coat	

Concrete towers for WTGS

Concrete towers for WEA are combined with steel segment buildings and are therefore used as hybrid towers. The requirement of concrete tower producers is that there is no visible difference between the concrete and steel tower surfaces after coating. A high specification, which novatic® coatings are able to fulfil.

novatic® has been supplying producers of concrete towers since 2004. The coatings are technically fully developed and have proved themselves on more than 7,000 towers.

The technical requirements are frequently underestimated as, beside an excellent long-term adhesion, they include a high UV-resistance and therefore colour and gloss stability, combined with the necessary weathering resistance. Wetness added to changing temperatures put strain on the coating. Our polyaspartic based novatic® top coat has specific water-repellent surface features, so rain water drips off and simply carries away adhering contaminating particles. Furthermore the surfaces dry uniformly, so no algae infestation occurs, which could happen on the weathering side of unprotected concrete surfaces.

It must be taken into account that concrete is alkaline, so within this pH range, impermanent prime coats do not ensure long-term adhesion. The primer has to wet the fresh concrete, which shows a residual humidity of 6 weight % during production process and act as a deep penetrating primer at the same time. By far the best results are achieved using EP-liquid resin and polyaspartic. The tear off test is the best to evaluate the adhesive strength. Long-term adhesion is ensured in values above 3,5 N/mm². Depending on the quality of the concrete, novatic® primers show higher tear-off values with a 100 % concrete breakout.

From a technological point of view the primers have to dry quickly to be adaptable to the usual production processes, which will be guaranteed when using novatic® coatings.

The subsequent structure of layers determines the choice of the primer.

Additionally, the coating is used to seal concrete imperfections, such as cavities, flaws and pores and therefore ensure a perfect surface.

The solution for this demand is found in special novatic® fillers, which are used at the same time as the primer, or within our novatic® sandwich system.

novatic® started the development of special concrete tower systems in 2003 with regard to different technological demands, various property rights, securing the formulations of the coating materials and coating systems. This coating system is especially low in VOC, as the SP22 filler is solvent free and ZD58 a high solid product. The polyaspartic-filler SP22 functions as a classic primer, as well as filling in flaws on the concrete surface e.g. cavities, holes and pores. It gets mounted and rejected on zero. The total consumption depends on the amount and size of the flaws and comes up to approx. 100 g/m².

Used with the ZD58 finishing coat and based on the material surface price, minimum effort, the system is cost-effective and furthermore enables a fast production cycle.

ZD58 coat is applied evenly or via airless spraying. The coat can also be applied by rolling. The ZD58 finishing coat is robust and mechanically loadable, so nearly no damage will occur during transportation or assembly.

There are other coating systems: a sandwich system and a system based on a waterborne 3C-EP-Primer and a waterborne 2C-PUR-material for use with e.g. filler SP22 to fill holes and pores.

Two examples for concrete tower coating systems:	
1 x 2C-PASP*-Filler LF SP22	approx. 50 µm
1 x 2C-PASP*-Top Coat ZD58	125 µm
1 x 3C-PASP*-Primer/Putty BG70	50 – 100 µm
1 x 2C-PASP*-Top Coat ZD58 (structure splash)/ZS58 (structure roll)	125 µm
*PASP: Polyaspartic	

Coating systems GFK-sheet:	
1 x 2C-PASP-In-Mould-Primer ZG57	50 – 150 µm
1 x 2C-PASP-Top Coat HS ZD58	150 – 200 µm

Additional products:
2C-PASP-Primer ZG58
2C-PASP-Filler SP21
2C-PASP-Pore filler LF SP22
ZV01 LEP Coating (Leading Edge Protection)

Coating for the inside of towers

When lightening a white, diffusion open dispersion colour can be used for coating the inside of towers. novatic® offers different options for this.

Rotor blade coating systems

Since 2010 novatic® has produced a different kind of rotor blade coating system. Developed from our research we now offer a high quality and technologically efficient 2 layer system. We also use polyaspartic coating system due to its quality and technological advantages, when compared to polyurethane. The polyaspartic coating system, which we have developed, is a two layer system of polyaspartic. It consists of primer and top coat. It is possible to apply it using a filler for filling, smoothing and modelling. The use depends on the surface quality.

In-Mould-Primer and Primer for the GFK-coating are available depending on the processing technology. The primers have

all the necessary features for the different technologies and show good adhesion to GFK. It is possible to apply by rolling or spraying. Flaws are easily seen on the GFK surface, due to the white colour shade of the primer, which can be sealed evenly by using a solvent-free pore filler SP22. It is to apply a High-Solid-Polyaspartic-rotor blade top coat ZD58 as an added top coat. Pot life of the material is in accordance with the industrial serial coating standards and has proven itself in practice. The rotor blade coat should be applied by airless-spraying, but airmix with additional air, as well as airless, with additional air and heating up to 35 °C is also possible. The best technical results are obtained by using a robot.

Good embedding of the spray mist leads to smooth and optically uniform surfaces.

The rotor blade coating material ZD58 may be applied up to a wet film thickness of 350 µm without any flaws, due to the chemical curing reaction there is no danger of CO2-bubbles or pores as it is within PUR-coatings. The advantage of the dense, closing film formation will directly affect the long term stability in the field, as rain erosion tests show.

Damages due to these kinds of imperfections within the coat are not possible with polyaspartic. Processing characteristics, durability and quality of the novatic® rotor blade coating system are proven by a vast variety of tests.

Tests: Rain erosion tests, adhesion test, condensation water test, salt spray test, cataplasm test, water immersion, tension tests of lose coating films to evaluate the max. tensile strength as well as the breaking tension and the ultimate elongation, UV-B-test after DIN EN ISO 11507/Verf. A hardness profile of the coating after application, ring line stability.

“Working in a partnership with our customers, we ensure the end quality of the WTGS coatings”

Drive technology, gondolas, hubs

Also for this field of application novatic® offers certified coating materials, primers based on epoxy resin, top coats based on polyurethane and polyaspartic. 2C-EP-Zinc dust primers und High-Solid-2C-EP-Zinc phosphate – primers ensure corrosion protection. The adhesion on non-iron materials is ensured by using special primers. Hot galvanised surfaces and thermal sprayed metal surfaces are protected by novatic® Duplex-Coatings according to DIN EN ISO 12944-5 tab. A7 and tab. A8.

Service

Working in a partnership with our customers, we ensure the end quality of the WTGS coatings. We offer our expertise for the selection of the coating, its adaption to the process technology and for the choice of the most cost-effective coating technology. Upon request, our technicians as well as paint inspectors, advise our customers with regard to the production and therefore participate in the quality assurance. At the request of a costumer we offer training at the customer’s location or at novatic®. We offer repair systems for the repair of transport and montage damage, for all kind of coating systems.

novatic® ensures the quality of the coating materials and systems by internal testing and testing at internationally renowned, independent testing institutes. Our extensive record of success over the last 20 years and more shows we comply with the demands and technical requirements of our customers. ■

www.novatic.com