Zinc Flake Coatings in the wind energy industry

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Zinc flake coating systems
Alternative to zinc or zinc alloy plating

- Zinc flake coating is a method to deposit electroless a cathodic protecting layer. Additional top coats increase the performance.

- The zinc flake coating has significantly increased its market share in recent years, in particular by applications on fastening systems.
  - approx. 70% of the fastening elements in North America
  - approx. 50% of the fastening elements in Europe
  - approx. 30% of the fastening elements in Asia

  And still growing!

- The trend to high strength steel requires suitable layer systems, which causes no stress corrosion by hydrogen embrittlement.
Zinc flake coating systems
Examples for applications in the Automotive- and Wind industry
Zinc flake coating systems
Examples for applications in miscellaneous industries

Wind power industry

Construction industry
High corrosion protection systems

Atotech is worldwide the only chemical supplier for corrosion resistant coatings offering a full range of

ZINC and ZINC ALLOY PLATING systems with POSTTREATMENT products

as well as a full range of

ZINC FLAKE COATING and MECHANICAL PLATING PROCESSES including equipment technology
Zinc flake coating systems
Base and top coats

Potential zinc flake coating combinations in the wind power industry

- Zintek® 200 + Techseal® Silver
- Zintek® 200 + Techseal® Black
- Zintek® 400
Zinc flake coating systems
Typical coating layer setup

- Metal substrate
- Degreasing - Shotblasting - Phosphating
- Basecoat
- Topcoat
Zinc flake coating systems
Base coat Zintek®

- Zinc flake base coats are highly reactive systems containing zinc and aluminum flakes.

- The flakes are lying upon each other, close-packed and parallel to the substrate boundary.

- After application and curing at approx. 200°C the dry film contains no nickel, lead, mercury, cadmium, chrome or cobalt.

- No acids and no electrical current are used on the parts => no risk of hydrogen embrittlement

- The zinc flake layer acts as a sacrificial anode and provides thereby cathodic protection to the substrate.

- Additional top coats can fulfill further coating properties
  - For example: Containing an internal lubricant allowing to achieve different friction coefficients
**Zinc flake coating systems**

**Structure of the Zintek® layer**

2 layers Zintek® 200

Comment: Detail
FE REM ZN Flakes: 9.07 – 10.22 µm
Zinc flake coating systems
Top coats

- Atotech’s top coats can be combined with zinc flake base coats as well as electroplated zinc or zinc alloy layers forming multifunctional coatings.

- The Techseal® product line provides organic top coats with highest chemical resistance, uniform appearance as well as increased corrosion protection with defined friction values.

- Zintek® Top is a reactive, inorganic silicate based top coat developed for application on Zintek® base coats. After curing the layer thickness is < 1 µm with a good barrier effect against oxygen.

- Multifunctional properties:
  - Increased corrosion resistance
  - Adjustment of defined friction values
  - Excellent adhesion
  - Available in different colors
  - Increased scratch resistance
  - Very good chemical resistance
  - Different colors for easy identification available
Zinc flake coating systems
Big sized fasteners for Wind Energy industry
Zinc flake coating systems
Examples for spray application
Zinc flake coating systems
Specification for Big sized dimension fastener for Wind Energy industry

- New increased requirements to rotor blade bolts

1200 h SST
10 cycles Kesternich test
Compatibility with MoS₂ lubrication grease
Zinc flake coating systems
Disadvantages of other corrosion protection systems

- Hot dip galvanizing => High unit weights and risk of solder brittleness. High process temperature can deform parts and will reduce steel hardness. Small holes in parts will be closed by a film, intensive rework needed.

- E-Coat paints => No sacrificial corrosion protection. Layer damage will easily lead to red rust and blistering/chipping off of the layer.

- Electroplating => No deposits in the interior of complex shaped parts/tubes. No protection inside and risk of hydrogen embrittlement

- Pre-zinc plated parts => No protection at the cutting edges.

Only dip drain zinc flake systems can overcome these problems!
Zinc flake coating systems
Approvals for Wind Energy industry

- Approvals
  - REpower
  - AREVA
  - and others

- Continuous enhancement with customers, TIER1s and OEMs

- New projects in discussion

- Expansion of technology to other countries
Zinc Flake Technology
Summary

- Zinc flake coatings have
  - no risk of hydrogen embrittlement
  - excellent corrosion protection
  - competitive costs
  - no waste water

- Atotech’s zinc flake products are fulfilling complex requirements for the windenergy industry and other applications

- Can be used on a wide variety of parts in bulk as well as rack application

- Different colors are possible by using our top coats

- Atotech can provide the full package: chemistry and equipment, all out of one hand

*Atotech is dedicated to drive the future zinc flake technology.*
Zinc Flake Coating Systems

Process steps

- Degreasing, shot-blasting or phosphating
- Dip-spin, dip-drain, spray or spin coating method
- Evaporation of solvents
- Conveyor belt oven, box oven, inductive curing
- Cool down of the parts

Temperature

- 60 – 110°C
- 180 – 250°C
- < 30°C

The dip-spin process sequence (without pretreatment) can be repeated in order to add further coating layers depending on the requirements.
Zinc Flake Coating Systems
Dip-spin process

Loading of parts
Dip 5 – 30 s at 35 rpm
Spin 8 - 20 s at 250 rpm
Unloading of parts

Atotech General Zinc Flake
Zinc Flake Coating Systems
Overview application methods

Pretreated parts

Dip-Spin

Standard equipment
Conventional centrifuge
Tilting centrifuge

Advanced equipment
Planetary centrifuge
Horizontal centrifuge

Dip-Drain

Spray

Conventional spray
E-Static spray

Curing

Spray application is used for big and complex shaped parts
Zinc Flake Coating Systems
Big sized fasteners e.g. wind energy industry

Spray application

Zintek® 200  Techseal® Black  Techseal® Silver
Zinc Flake Coating Systems
Overview application methods

Pretreated parts

Dip-Spin

Dip-Drain

Spray

Standard equipment

Advanced equipment

Conventional centrifuge

Tilting centrifuge

Planetary centrifuge

Horizontal centrifuge

Conventional spray

E-Static spray

Curing

Dip-Drain method is used for big and complex shaped parts
Zinc Flake Coating Systems
Dip-drain process

Process flow:
- Dipping of the part into the paint
- Wet layer formation by draining the part
- After pre-drying the coating process is completed by oven curing
Thank you for your attention!