RoHS Compliant, Non-Chrome Passivation of Galvanized Steel with Lugalvan™ Passivation Products

Grace Chang, Charles Kerobo, Mirjam Herrlich-Loos, Helmut Witteler

Product Development Surface Finishing
Lugalvan™ Passivation — Application Post-Treatment —

- Lugalvan™ Passivation has been developed for spray + squeegee operation
- ... works on chemcoaters as well
Traditional Technology based on Cr(VI)

- Formation of a Cr(III)-Zn(II)O_x layer
- Self-repairing by Cr(VI) incorporation

... will be banned...

- in electric appliances, July 2006, EU
- in cars, July 2007, EU
A New Working Concept: Passivation Layer from Polycarboxylate

1. Metal is dipped into acidic aqueous polycarboxylate solution.
2. Zinc dissolves in the acidic solution.
3. Zinc forms a metal salt with the polycarboxylate acting as passivation layer.
4. Mobility of polycarboxylate allows self repair.
Lugalvan™ Passivation
Conversion Layer Formation

Formation of a uniform film

Reaction of the passivation with adhering ZnO/ZnCO₃

Untreated zinc; structure originating from adhering ZnO/ZnCO₃
Lugalvan™ Passivation

- Organic conversion layer
- No heavy metals
- No fluoride
- VOC-free, no organic solvents
- Aqueous solution
- Excellent corrosion protection
- Self-repairing
- Proprietary BASF technology
Lugalvan™ Passivation — Application —

- On Zinc, HDG or EG steel
- Squeegee rollers or coil coating application
- Drying
  - Dries without heating
  - Drying up to 180°C possible
  - Proven on production line with PMT 40°C / 3 sec
- Coating weight < 0.3 – 0.5 g/m²
- Hydrophilic surface
- Compatible with organic coatings
Lugalvan™ Passivation
— Morphology —

- Top view: surface has been scratched after exposition to salt spray
- Scanning electron microscopy with integrated EDX
Self-repair of Lugalvan™ Passivation

- Zn-depleted
- Zn-rich zinc

Deformation

Contact with water

Repair
Self-repair of Lugalvan™ Passivation

A scratch in a polymeric passivation layer before ...

... and after self-repair.
Self-repair of Lugalvan™ Passivation
- X-Cut Test (after 24 h salt spray test) -
Lugalvan™ Passivation – Benefits to Steel Makers

✓ **Heavy metal free product:**
  - RoHS compliant and well positioned to meet future regulatory restrictions
  - Reduced health hazards compared to Chromium based products
  - Eliminate chromium-based waste disposal

✓ **No handling and exposure issues with hydrofluoric acid**

✓ **Improves equipment durability:**
  - Minimized corrosion on production equipment

✓ **Enhanced corrosion performance**
  - Superior corrosion protection in salt spray test, 48 to 96 h
  - Excellent appearance achieved in trials
  - Target reduction in number of claims and returns
Lugalvan™ Passivation – Benefits to Steel Companies’s Customers

- RoHS Compliant – High Performing Non-Chrome ChemTreat
- Reliable supply of high quality steel:
  - Paintability
    - Direct Powder Coating
    - Complete Removal for High End Paint lines
- Sufficient Resistivity
- Positive feedback regarding formability and weldability
Lugalvan™ Passivation – High Performance Conversion Coating

- One step
- No heavy metals, no fluoride
- No rinsing, no toxic waste
- No VOC
- Self repair
- Excellent corrosion protection
- Excellent lacquer adhesion