M-PP AUTODEPOSITION 966 COATINGS AND UV CURABLE POWDER COATINGS

Todd Coggins Henkel Corporation
Mike Knoblauch Keyland Polymer UV Powder
Abstract

Bonderite M-PP 966 coating has achieved high levels of performance on Neutral Salt Spray (NSS) testing and automotive Original Equipment Manufacturer (OEM) cyclic corrosion tests. This epoxy-acrylic urethane coating has excellent thermal stability, topcoatability, edge protection, and flexibility while maintaining a low-cure temperature. Bonderite M-PP 966 when used in combination with Keyland Polymer’s UV-cured powder coatings offers the end user high levels of corrosion and finish performance; significant energy, plant footprint and resource savings and increased productivity. This presentation will illustrate and demonstrate the performance attributes of each material and the synergistic process benefits when they are used in combination.
M-PP Autodeposition 966 Coating
Engineered Solutions for Automotive Challenges

Henkel Solutions

- Body Sealing & Coating
- Assembly Adhesives
- Acoustics & Structural Adhesives
- Engineering Adhesives
- Surface Treatment
- Cleaners & Lubricants

Market Needs

- Powertrain
- Chassis
- Body In White
- HVAC
- Electronics
- Exterior
- Interior
The BONDERITE® M-PP Process (former AQUENCE)

Metal Pre-Treatment - Paint Process

BONDERITE Metal Pre-Treatment Paint Process is a chemical coating used in a process where an organic polymeric emulsion chemically deposits on the surface of a clean metal substrate. BONDERITE Metal Pre-Treatment Paint Process (BONDERITE M-PP) is known as the "simple solution" because it reduces the number and complexity of stages involved in painting parts.
Bonderite® M-PP 966 Technology

• Bonderite M-PP Coatings are environmentally responsible
• Very Low Volatile Organic Compounds (VOC) and eliminates hazardous air pollutants (HAPs)
• Alkyl Phenol Ethoxylates (APE) free
• Compliant to various regulatory directives or registrations: RoHS, ELV and WEEE
• No toxic heavy metals as supplied
• Significant process improvements
• Decreased energy consumption
• Simplify wastewater treatment and disposal
• Smaller equipment footprint
### Bonderite® M-PP 966 Process Functions

**Clean**

Function: Coating Properties and Adhesion
- Alkaline Cleaner: Soil and Lubricant Removal
- Acidic Cleaner (optional): Welds, Edges, Heat Affected Zones

**Rinse**

Function: Provide Barrier Protection Coating
- M-PP Coating: Polymer and Pigments
- Inorganic Starter Package

**Coat**

Function: Passivation Layer Protection
- Melt, Coalesce and Dry Coat
- Organic Metallic Chemistry

**Rinse**

**Seal**

**Cure**

Function: Cure
- Chemical Cure Stand Alone Coating
- Co-Cure: Physical Dehydration for Primer Application
Bonderite® M-PP 966 Coating Stages

Chemical, **Not** Electrical Deposition (e-coat)
Direct to Metal Application, **No** Pretreatment
Simpler, **Fewer** Stages Easier to Control and Maintain
<table>
<thead>
<tr>
<th>Interior</th>
<th>Suspension</th>
<th>Chassis</th>
<th>Powertrain</th>
<th>Exterior</th>
</tr>
</thead>
<tbody>
<tr>
<td>• seat frames</td>
<td>• shock and struts</td>
<td>• frames</td>
<td>• gear boxes</td>
<td>• low cost vehicles</td>
</tr>
<tr>
<td>• seat tracks</td>
<td>• control arms</td>
<td>• trailer hitches</td>
<td>• drive shafts</td>
<td>• small trucks</td>
</tr>
<tr>
<td>• foot pedals</td>
<td>• coil springs</td>
<td>• top mounts</td>
<td>• motor mounts</td>
<td>• truck cabs</td>
</tr>
<tr>
<td>• door / window frames</td>
<td>• top mounts</td>
<td>• engine cradles</td>
<td>• battery trays</td>
<td>• motor cycles</td>
</tr>
<tr>
<td>• safety / restraint parts</td>
<td>• rubber to metal</td>
<td>• ACE frames &amp; structure</td>
<td>• dust covers</td>
<td>• construction equipment</td>
</tr>
</tbody>
</table>

M-PP 966

Bonderite
Technology Highlight

Bonderite M-PP 966

- Matte Black, Autodeposition corrosion resistant coating for hot and cold rolled steel.
- Oven cure < 270 F.

Features and Benefits

**Mini-Emulsion**
- Coat full assemblies with improved corrosion performance.

**Environmental Stewardship**
- HAPS Free
- Low VOC

**Meets performance specifications**
- Improved corrosion protection capabilities that meet OEM standards.

Target Components

- seating
- suspension
- drive shafts
- rubber to metal
- shocks
- struts
M-PP® 966 Coatings Process Advantages

**Coats Full Assemblies**
- Ability to Coat Working Assemblies
- Lowers Inventory Requirements
- Eliminates Masking

**Throw Power, Inside Coverage**
- Virtually Unlimited Throw-power
- Coverage Prevents “Inside-Out” Corrosion

**Edge Coverage**
- Uniform Coating Around Edges
Process Value Proposition

- Reduced capital investment (40% savings compared to Ecoat)
- Time to market: <26 weeks to build new line
- Reduced energy demand/consumption
- Process flexibility:
  - Small footprint
  - Less ancillary equipment
  - High rack density, increase productivity
  - Reduced operation labor; fewer chemical stages to QC and maintain
- Total Cost/Sq. ft. savings 10-15% less than Ecoat
- Environmental sustainability
- Excellent Henkel technical support
The Simple Coating Solution Summary

- Recent GM 15-Year Corrosion Approval (GM 14872 Exposure E)
- Replaces galvanized metal, zinc phosphate and electrocoat in a single process
- Direct to metal application (no rectifiers needed)
- Coating is environmentally friendly (green chemistry)
- Excellent corrosion performance
- Superior edge coverage / interior protection
- Reduced overall process costs
UV-Curable Powder Coatings
The differentiating characteristic of UV-curable powder coating is the separation of melt & flow from cure.

**Thermal Powder Coating**
1. Substrate Pretreatment
2. Electrostatic Powder Deposition
3. Melt, Flow & Cure (5 to >60 mins + cooling)
4. Finished Product

**UV Powder Coating**
1. Substrate Pretreatment
2. Electrostatic Powder Deposition
3. Melt & Flow (1-2 minutes)
4. UV Cure (seconds)
   - Minimal cooling
5. Finished Product
UV-Curing – Free Radical Cross Linked Coating

Resin Photopolymer → Induced polymerization by light

عقايل نيترا̀ل فري مجفف عديله ماسولا متعلقه

Photoinitiator

Resin Photopolymer

Induced polymerization by light

UV light
Time and Temperature Process Efficiency

- **Start**
- **Enter Preheat**
- **Enter Melt/UV Oven**
- **Enter Application**
- **Hold Temperature**
- **Exit Melt/UV Oven**
- **Leave Preheat**
- **Leave Melt/Cure Oven**
- **Leave Melt/Cure**
- **End**
### Square Footage Comparison Between Current System and UV System

<table>
<thead>
<tr>
<th></th>
<th>Current System Size 2165 sqft</th>
<th>UV System Size 300 sqft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cure oven 1625</td>
<td></td>
<td>Gas catalytic 250</td>
</tr>
<tr>
<td>Air conditioner 540</td>
<td></td>
<td>UV lamps 50</td>
</tr>
</tbody>
</table>
UV-Cured Powder Coating Thermal Profile

Melting powder not heating part

1 second
65° C

47 seconds
78° C

96 seconds
104° C

Total time in front of IR panel 120 seconds
Total dwell time in front of IR panel 96 seconds
Surface temperature end of cure – 85° C
Examples of Parts Bonderite M-PP 996 and UV Cure Powder

- Pneumatic closure
- Oil filter
- Shock absorber
- Head gasket cover
- CV joint
Benefits of Bonderite M-PP 996 Combined with a UV-Cured Powder System

- **SAVES ENERGY**
- **LOWERS COST OF QUALITY**
- **REDUCES PLANT FOOTPRINT**
- **PRODUCES HIGHER PROFITS PER HOUR**
- **INCREASES MANUFACTURING FLEXIBILITY AND PRODUCTION CAPACITY**

- No solvents
- No water
- Less energy
- Less time
## Bonderite M-PP 996 with UV-Cured Powder Performance

Bonderite M-PP 966 + UV Cured Powder meets or exceeds OEM requirements

- GM 15-year corrosion requirement
- Passes ASTM B117 1000 hour salt spray

### Performance

<table>
<thead>
<tr>
<th>Pretreatment</th>
<th>966 Full Cure</th>
<th>930/E2 Co-Cure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Film Build Range (mils)</td>
<td>1.7 - 2.3 mils</td>
<td>1.7 - 2.3 mils</td>
</tr>
<tr>
<td>60° Gloss</td>
<td>75-83</td>
<td>78-83</td>
</tr>
<tr>
<td>Pencil Hardness</td>
<td>3H</td>
<td>3H</td>
</tr>
<tr>
<td>50 MEK Test*</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Crosshatch Adhesion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>@ 1.6 mils</td>
<td>4B+</td>
<td>4B+</td>
</tr>
<tr>
<td>@ 1.8 mils</td>
<td>5B-</td>
<td>4B+</td>
</tr>
<tr>
<td>@ 2.0 mils</td>
<td>5B-</td>
<td>4B+</td>
</tr>
<tr>
<td>@ 2.2 mils</td>
<td>5B-</td>
<td>4B+</td>
</tr>
<tr>
<td>@ 2.4 mils</td>
<td>5B-</td>
<td>5B-</td>
</tr>
<tr>
<td>@ 2.6 mils</td>
<td>5B</td>
<td>5B</td>
</tr>
<tr>
<td>@ 2.8 mils</td>
<td>5B</td>
<td>5B</td>
</tr>
<tr>
<td>@ 3.0 mils</td>
<td>5B</td>
<td>5B</td>
</tr>
<tr>
<td>@ 3.2 mils</td>
<td>5B</td>
<td>5B</td>
</tr>
</tbody>
</table>

*Internal measurement where 0 is worst and 10 is best*
Questions

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