Silver metallization and Selective Metallization by Spraying on Film
1. Company
2. Technology
3. Jet Selective technology - NEW
4. Application fields
Company

Today: Located in Lyon, France, ~ 25 people

Company strategy: Sell technology
Agenda

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1. Spraying of 2 water based solutions (oxidant = Ag metal salt & reducer) with standard painting equipment at ambient pressure and temperature

2. Redox reaction resulting in immediate growth of metallic layer on the substrate
Ag metallization by spraying
Sequence of process steps

1. **Surface preparation** (e.g. flaming, plasma, corona, sandblasting, chemical activation, ...) to increase wettability > 60 Dyn / cm

2. **Surface activation**

3. **Rinsing** with DI water

4. **JMT Redox reaction**

5. **Rinsing** with DI water

6. **Water evacuation** via air blowing
Sequence of process steps
Substrate materials

Basically all materials which can be made ‘wettable’ (with or without a surface preparation step) can be metallized

- Metals and alloys
- Plastics & composites

<table>
<thead>
<tr>
<th>Composites</th>
<th>Plastics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Epoxy composite</td>
<td>Acrylonitrile-butadiene-styrene</td>
</tr>
<tr>
<td>PA composite</td>
<td>Acrylonitrile-butadiene-styrene / Poly carbonate</td>
</tr>
<tr>
<td>PEEK composite</td>
<td>Expanded Polypropylene</td>
</tr>
<tr>
<td>Polyester composite</td>
<td>Polyamide / glass fibre</td>
</tr>
<tr>
<td>PEEK composite</td>
<td>Polyether ether ketone w carbon</td>
</tr>
<tr>
<td>PEI composite</td>
<td>Polyetherimide</td>
</tr>
<tr>
<td>PET composite</td>
<td>Poly Ethylene Terephtalate</td>
</tr>
<tr>
<td>PI</td>
<td>Polyimide</td>
</tr>
<tr>
<td>PMMA</td>
<td>Poly methyl methacrylate</td>
</tr>
<tr>
<td>POM</td>
<td>Poly oxy methylene</td>
</tr>
<tr>
<td>PP</td>
<td>Polypropylene</td>
</tr>
<tr>
<td>PPSU</td>
<td>Polyphenylsulfone</td>
</tr>
<tr>
<td>PUR</td>
<td>Polyurethane</td>
</tr>
<tr>
<td>PVC</td>
<td>Poly Vinyl Chloride</td>
</tr>
</tbody>
</table>

- Other (Glass, Ceramics, leather, …)

Metallization of a 2D or 3D shape is a matter of adapting the surface pretreatment step
### Process characteristics

<table>
<thead>
<tr>
<th>Ag deposition speed</th>
<th>• From 12 µm/h up to 22 µm/h depending on the chemistry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Layer thickness</td>
<td>• Typically 20 nm → 3 µm</td>
</tr>
<tr>
<td></td>
<td>• Layers up to 10 µm are technically feasible but cost effectiveness must be checked case per case</td>
</tr>
<tr>
<td>Reflectivity</td>
<td>• Visible light: average 95%</td>
</tr>
<tr>
<td></td>
<td>• IR: &gt; 97% reflected</td>
</tr>
</tbody>
</table>

![Graph showing resistivity vs. thickness for JMT Ag layer and Metal Ag resistivity (1.59 x 10^-8 Ωm)](image)
Process characteristics

EMI shielding properties

Average attenuation of 65 – 70 dB between 10 MHz & 10 GHz with a 500 nm thick Ag layer!
Process: Advantages

1. Environmental green technology
   - Water based
   - CMR, solvent & Pd free solutions

2. Cost effective alternative for PVD, plating, evaporation, ...
   - High volume production as easy in-line industrialization
   - Moderate investment cost as working in ambient pressure / temperature
Process Advantages

3. Flexible:

- Metallization of complex shapes in small or big dimensions
- Metallization in both horizontal or vertical direction
- Metallization on many substrate materials: plastics, ceramics, glass, metal, silicon, composites, foils,...

4. Low technology barrier because based on standard painting technology
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Jet Selective technology: principle (1)

- **One additional step**, compared to the standard metallization process, after the surface preparation and before the activation.
- Deposition of a **pattern**, which will act as a negative mask, by printing (e.g., inkjet printing, screen printing, ...) with an organic protective layer on the surface of the substrate.
- After the metallization step, this organic protective layer is **removed** leaving no metal depositions where the pattern was.
Jet Selective technology: principle (3)
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Application fields

Decorative Applications
- Cosmetic market applications
- Automotive applications
- Building applications
- Window frames
- Tiles / ceramics

Application areas

Functional Coatings
- Anti-bacterial coatings
- Conductive coatings
- EMI shielding
- Intermediate conductive layer on non conductive parts
  - Electro forming
  - Powder coating
  - Plating
**Application fields**

**Decorative Applications**
- Cosmetic market applications
- Automotive applications
- Building applications

**Functional Coatings**
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**Application areas**
- Plastics
- Bottles
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**Film applications**
Web Applications actually in the pipeline

Complete surfaces metallized with Ag

- **Textiles** (PE, PA)
  - EMI shielded textiles
    - Plain textiles
    - Velcro
    - Zipper band
  - Increase reflectivity (VIS & IR) for curtains
- **Plastic films** (oa PET)
  - Decorative applications in thermo-formable applications
- **Leather**
  - Creating heatable leather products
- **Metal foil**
  - Decorative applications on Sn band
Web Applications actually in the pipeline

Ag Selective Metallization

- Plastic films (oa PET, PE like Mylar)
  - Antenna’s
  - RF ID
  - Intelligent sensors
  - Flexible electronics
Thank you!
Any questions?