



## **Silver metallization and Selective Metallization by Spraying on Film**

AIMCAL R2R Conference 2017, Oct 16 2017, Naples, FL, USA



# Agenda

1. Company
2. Technology
3. Jet Selective technology - **NEW**
4. Application fields



# Company

**1997**

Innovative  
metallization  
technology  
developed

**2007**

Start of  
Jet Metal  
Technologies

**2009**

First  
commercial line  
sold

**2016**

20<sup>th</sup>  
commercial line  
installed



**Today:** Located in Lyon, France, ~ 25 people

**Company strategy:** Sell technology



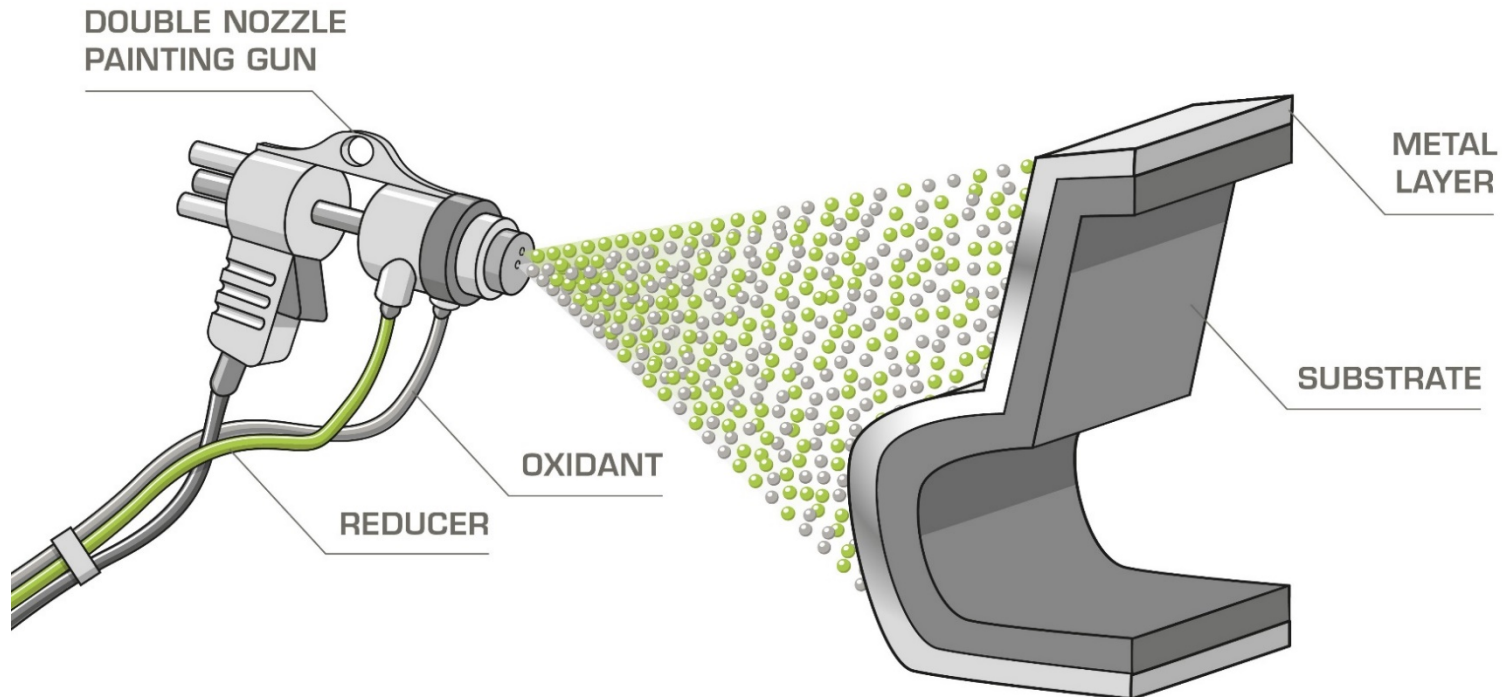
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# Ag metallization by spraying

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

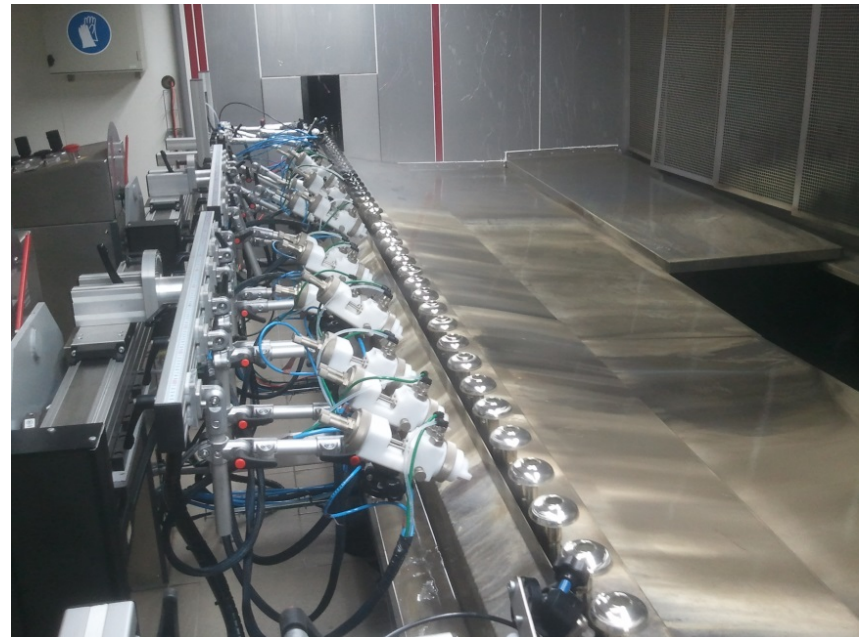
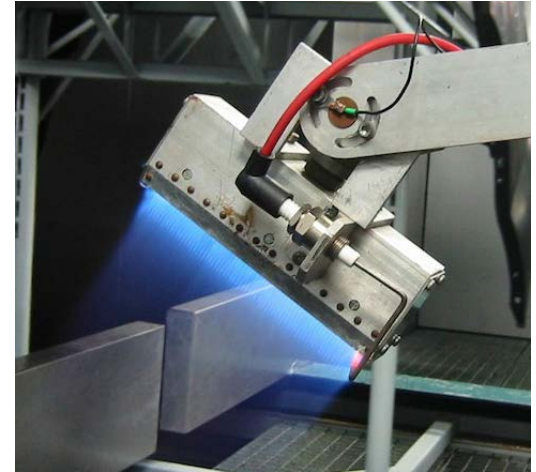




# Ag metallization by spraying

# Sequence of process steps

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

Composites	
Epoxy composite	Epoxy with carbon
PA composite	Polyamide / glass fibre
PEEK composite	Polyether ether ketone w carbon
Polyester composite	Polyester / glass fibre

- Other (Glass, Ceramics, leather, ...)

→ Metallization of a **2D** or **3D** shape is a matter of adapting the surface pretreatment step

Plastics	
ABS	Acrylonitrile-butadiene-styrene
ABS/P C	Acrylonitrile-butadiene-styrene / Poly carbonate
EPP	Expanded Polypropylene
PA	Polyamide
PC	Poly Carbonate
PE	Polyethylene
PEEK	Polyether ether ketone
PEI	Polyetherimide
PET	Poly Ethylene Terephthalate
PI	Polyimide
PMMA	Poly methyl methacrylate
POM	Poly oxy methylene
PP	Polypropylene
PPSU	Polyphenylsulfone
PUR	Polyurethane
PVC	Poly Vinyl Chloride



# Process characteristics

## Ag deposition speed

- From 12  $\mu\text{m/h}$  up to 22  $\mu\text{m/h}$  depending on the chemistry

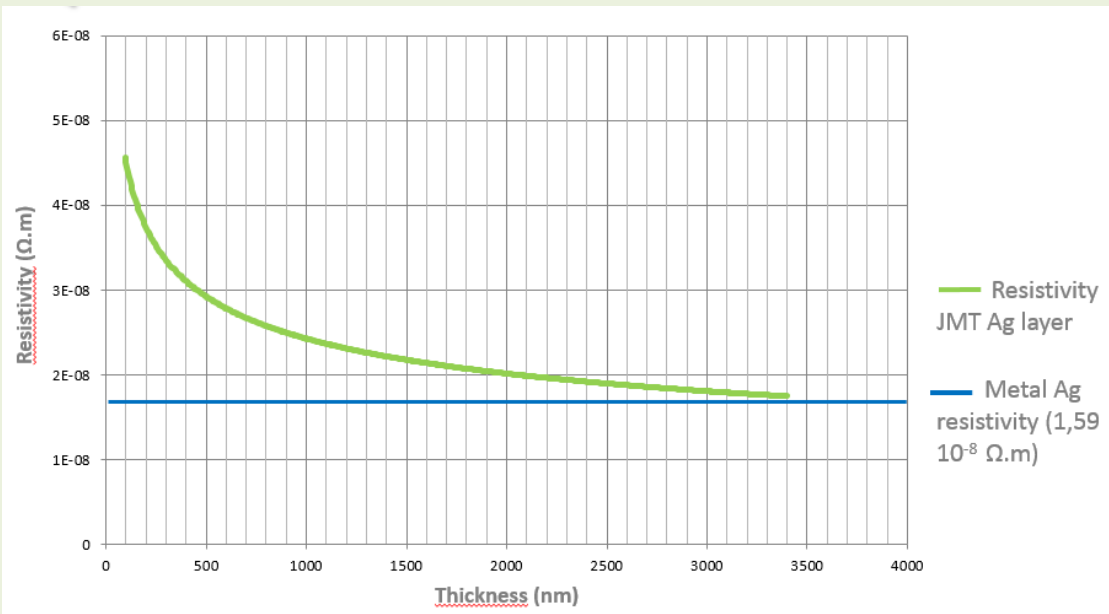
## Layer thickness

- Typically 20 nm  $\rightarrow$  3  $\mu\text{m}$
- Layers up to 10  $\mu\text{m}$  are technically feasible but cost effectiveness must be checked case per case

## Reflectivity

- Visible light: average 95%
- IR: > 97% reflected

## Electrical conductivity

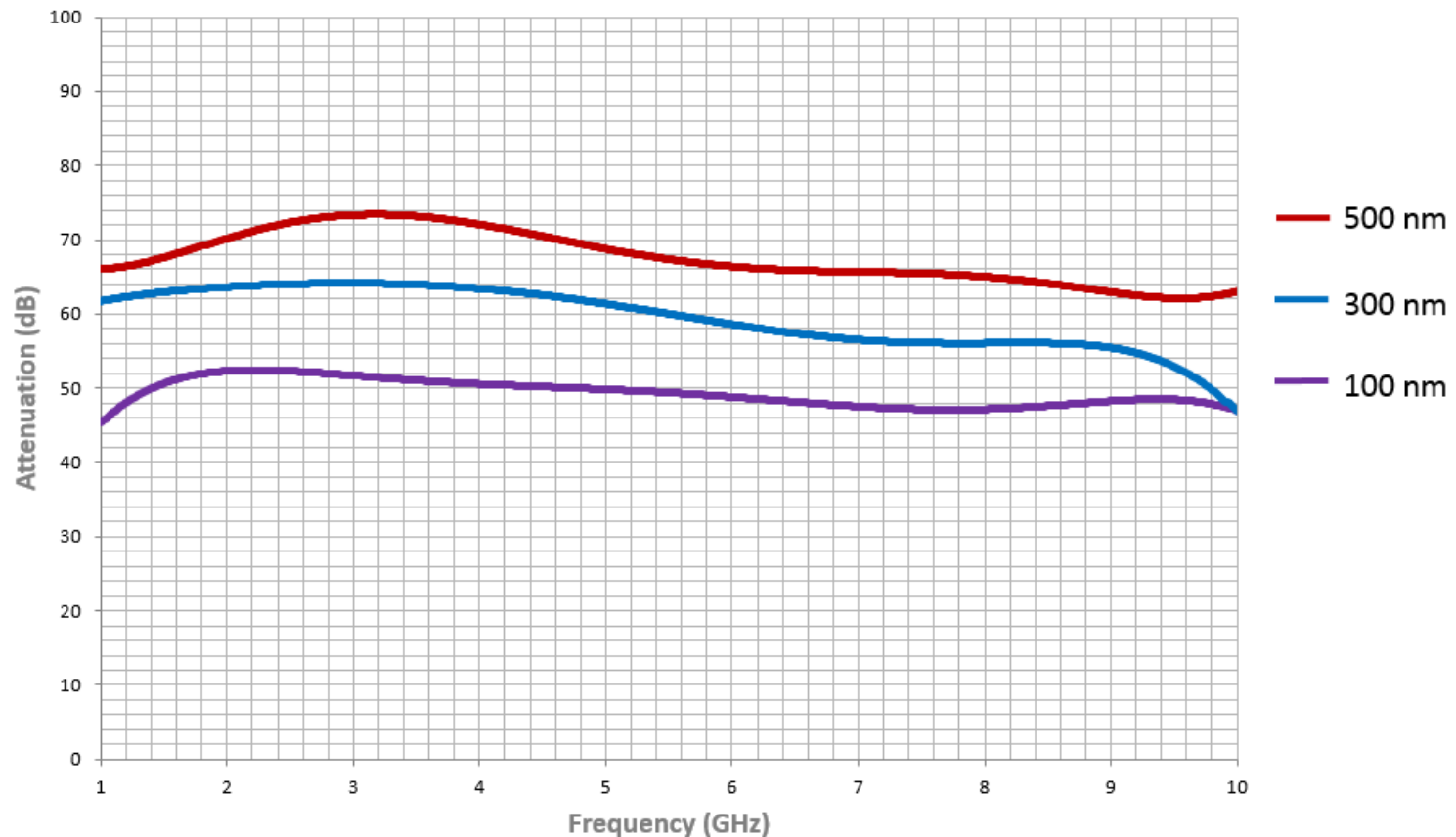




# Process characteristics

## 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



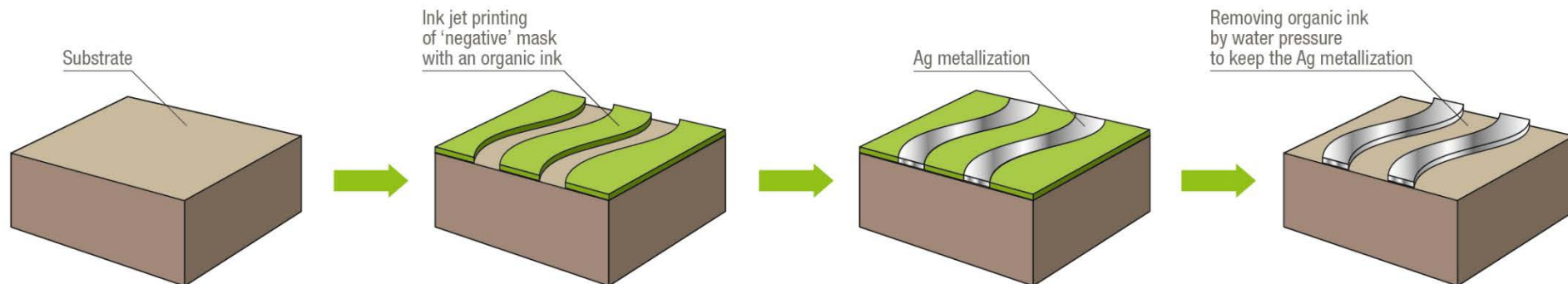
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# Jet Selective technology: principle (1)

- **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 (eg 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)



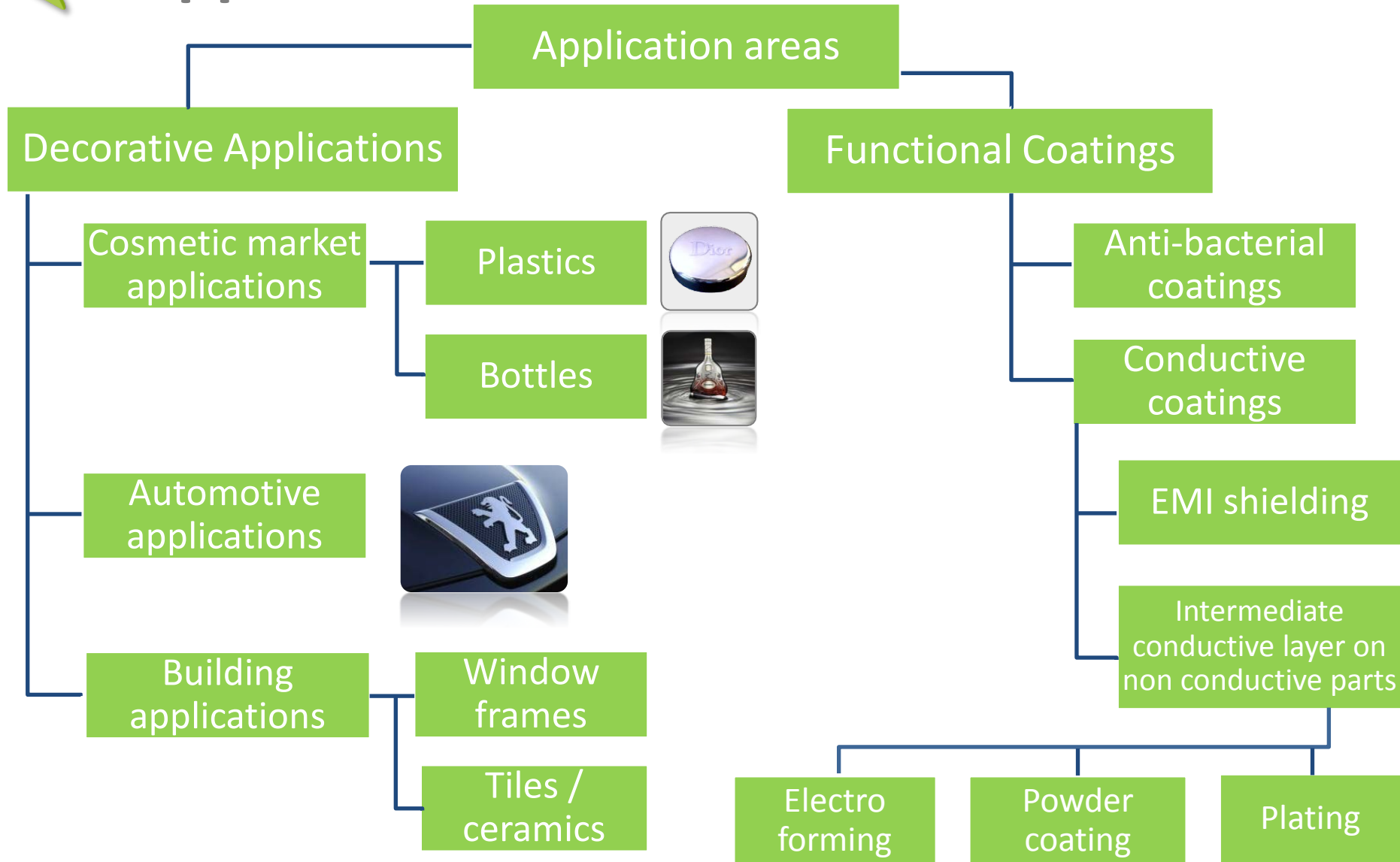


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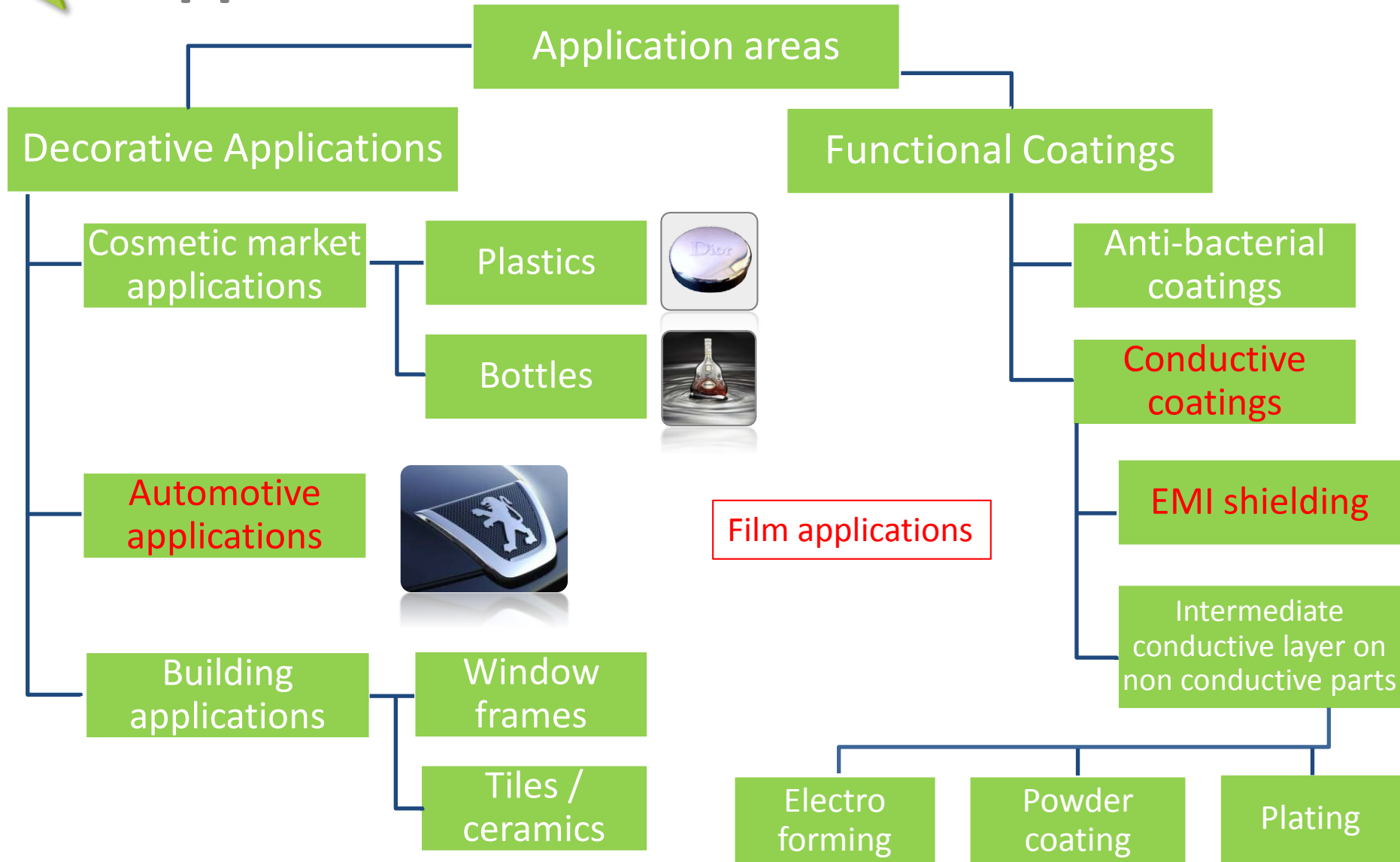


# Application fields





# Application fields





# 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 ?*