Innovative Decorative Coatings Replacing Plating on Plastics for Automotive Industry

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Introduction

Contents of the presentation:

1. Introduction IHI Hauzer Techno Coating B.V.
2. Introduction PVD technology
3. Replacement of Electroplating by PVD on plastics
4. Mass production Metalliner® concept

IHI Hauzer Techno Coating B.V.

- Design, assembly and commissioning of PVD/ plasma equipment and turn key solutions
- Development of process, hardware, application and pilot production
- 3 Competence Centres in Europe & Asia
- > 375 Systems installed worldwide
- 30 Years experience in PVD technology
- 150 Employees (> 40% engineers)
- Part of Japanese IHI Group

Core Business

Equipment for Decorative Applications

Equipment for Tribological Applications

Equipment for Tool Applications

Innovative Equipment

Introduction to PVD Technology

PVD= Physical Vapour Deposition

Vaporization of a pure solid material, evaporated material condenses on substrate surface and thin (typically few µm) metallic or ceramic layer is formed.

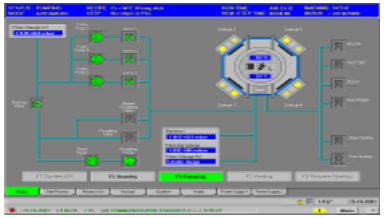
PACVD = Plasma Assisted Chemical Vapour Deposition *(= PECVD)*

Cracking of gas molecule and recombination and/or decomposition of gas as condensation on substrate surface

Main Functionalities of PVD/PACVD Coatings

- Increase wear resistance
- Reduce friction
- High thermal stability
- Improved corrosion resistance
- Fashionable color

PVD Coating Process



Control

Process gas

Vacuum measurement

Heaters

Vacuum pump

Table with products

Cathode

3-Fold Rotation

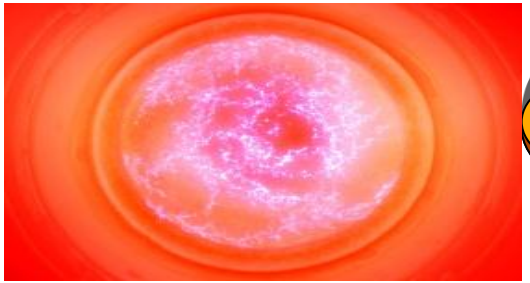
Vacuum chamber

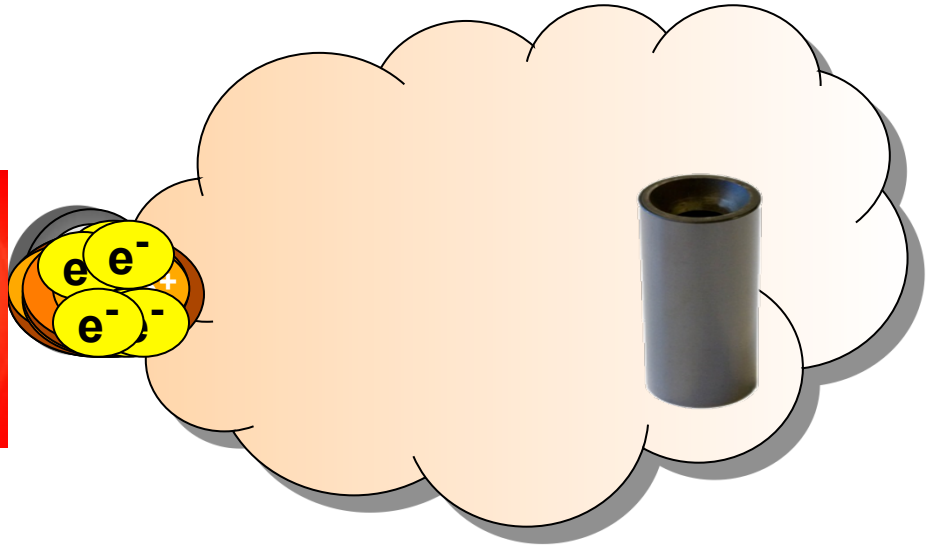
Power supply

Bias power supply

Technology: Arc

Arc Plasma



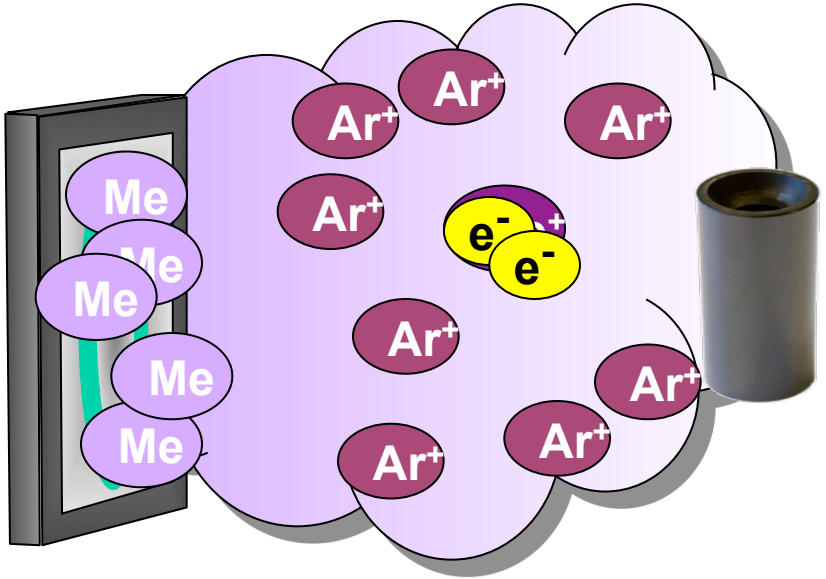


● droplets

90% metal ions

Technology: Magnetron Sputtering

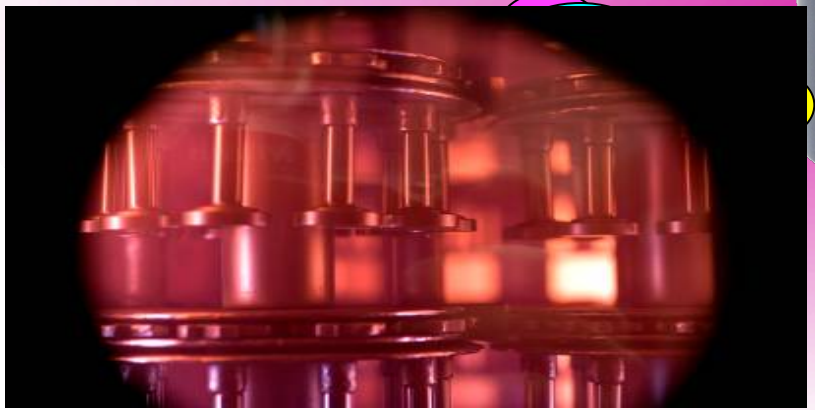
DC Sputter Plasma

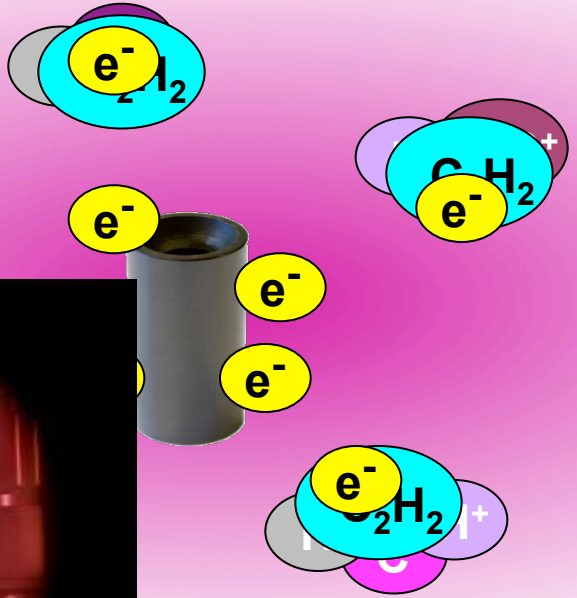


5% metal ions

Technology: Plasma Assisted CVD

PACVD Plasma





Applications of PVD Coatings

Many applications and possibilities for PVD coatings

In this presentation: potential of PVD technology

1. **Replacement of Cr Plating for Plastic Components**
2. **Low friction and wear resistant Carbon Coatings for the Automotive Industry (Thursday October 30th; 13:30)**

Trends

Trends in automotive affecting surface treatment & coating technology

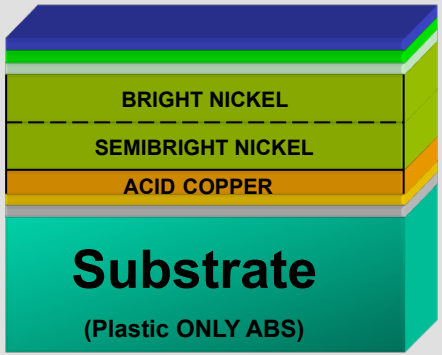
- Reduction of fuel consumption and CO2-emission.
  - *Use of light weight materials.*
- Replacement of conventional processes towards process for non Hazardous and non Volatile organic compounds
  - *Elimination of Cr^{6+} containing processes*
- Drive to reduce waste, energy consumption, process footprint, costs

Replacing Plating on Plastics by Lacquer/PVD process

Lacquer/PVD coating → Chromatipic®

Plating on Plastics versus Lacquer / PVD process

Traditional Cr Plating



> 10 steps

Cromatipic
Lacquer / PVD (Cr)

Hauzer®

SIDASA
UCG Units Coating Group

2 or 3 layers

Coatings on Plastic Parts

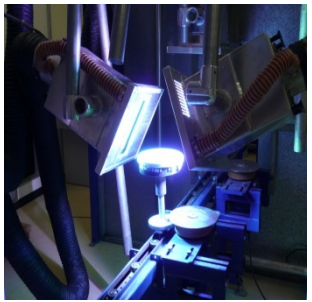
Advantages of the PVD/lacquer processes:

- Dry plating Cr process: eliminates the use of Cr^{6+}
- Wide range of substrate materials are possible:
  - Al and Al alloys, ABS, ABS-PC, ASA, PC, PS, PET, PP, PPE, PA, PA-MF, PA-GF, PPA-GF
- Different metal colours possible
- No corrosion risk

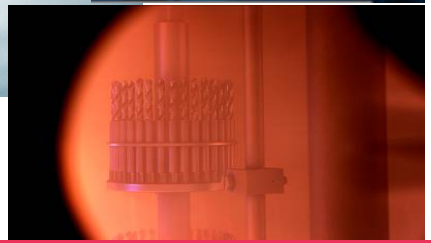
Coatings on Plastic Parts

Two-step lacquer/PVD process

Spray coating of lacquer



UV curing

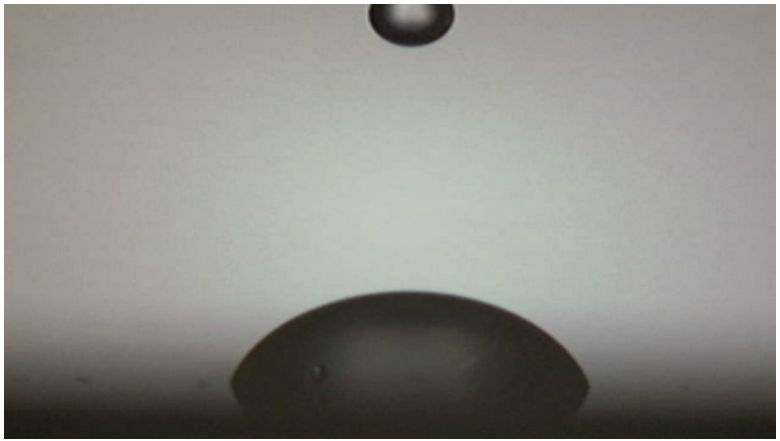


Plasma sputter & PACVD

PVD on Plastics: Adhesion Optimization

Activation of the Polymer Surface –
Ar or Ar/N_2/O_2 Plasma by 40 kHz MF Plasma Generator

Contact Angle of H_2O Droplet

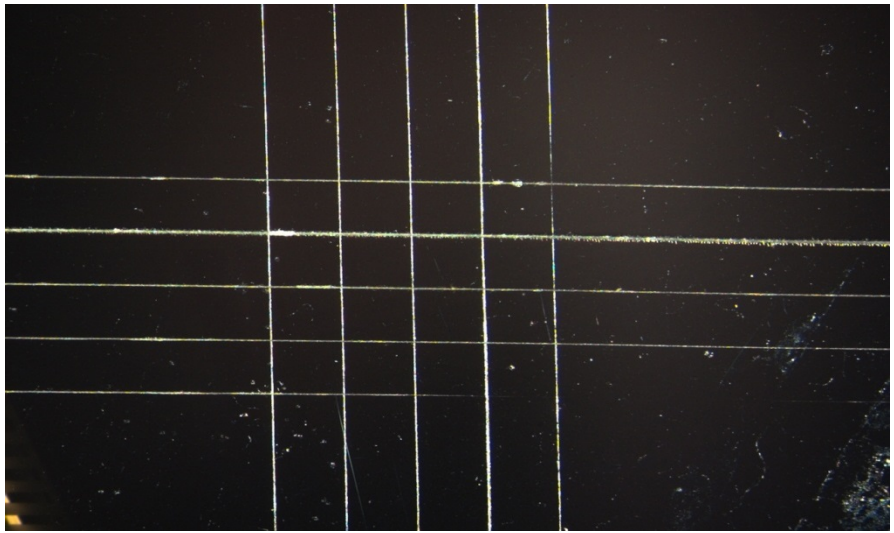


Before: $\theta \approx 75°$

After: $\theta < 5°$

PVD on Plastics: Adhesion

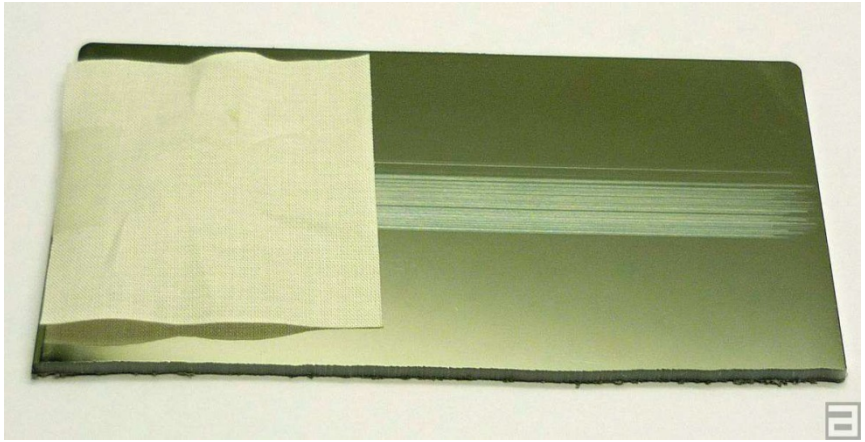
Adhesion by Crosshatch Tape Test (EN ISO 2409)



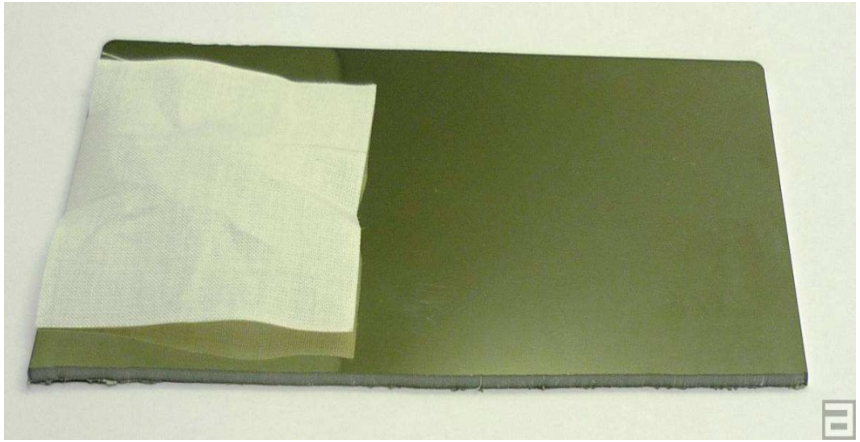
PVD on Plastics: Wear Resistance

Contribution of the Top Coat (SiO_2)

Crockmeter Test, DIN EN 20105-A03 (100 cycles, load 900g)



Without Top Coat (SiO_2)



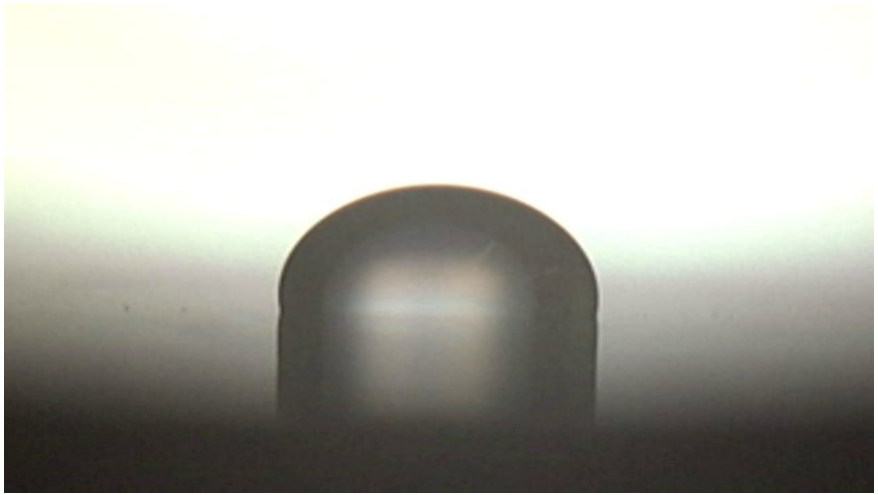
With Top Coat (SiO_2)

Results of Coatings in Metalliner®

Contribution of the Top Coat (SiO_2)

Hydrophobicity – Fingerprint Resistivity

PVD+lacquer only $\theta \approx 27°$



PVD+lacquer+Top Coat $\theta \approx 102°$

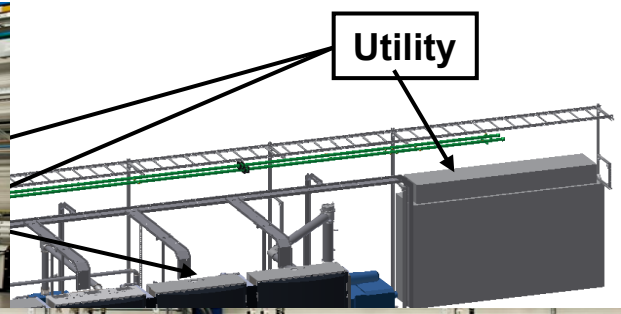
“Russian” Test Results after 336 Hours

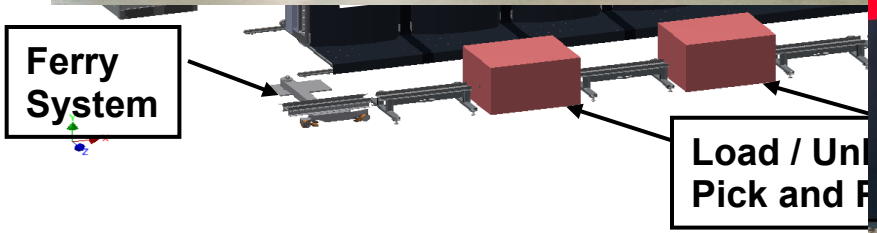
Fulfill the performance criteria against CaCl2 road salt test

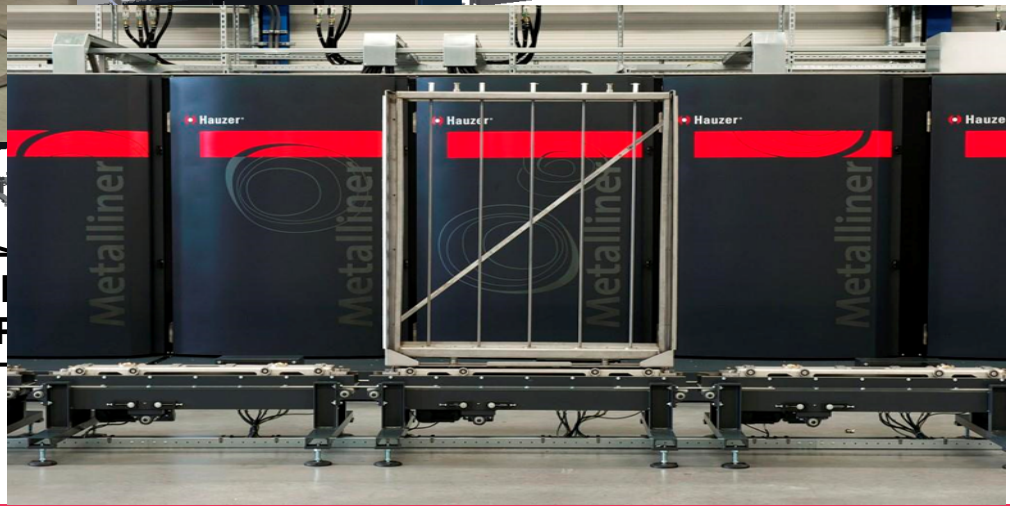
A: I

B: I

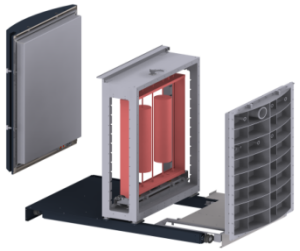
Mass production concept for coatings on plastics: Metalliner®



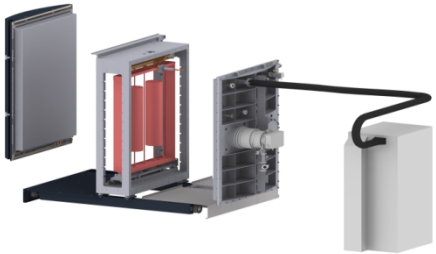




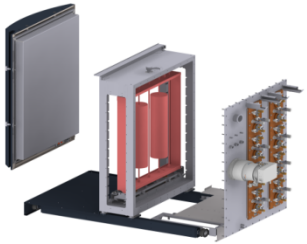
Modular design



Buffer



Pump with Meissner

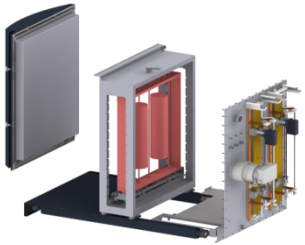


including rotation

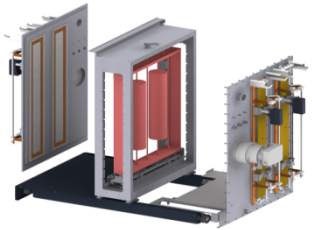
Cathode,

sputtering

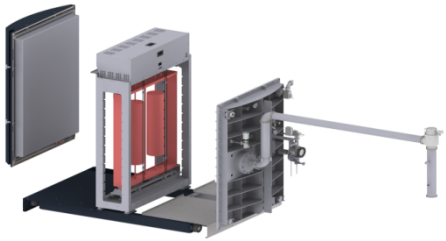
ARC



Sputter



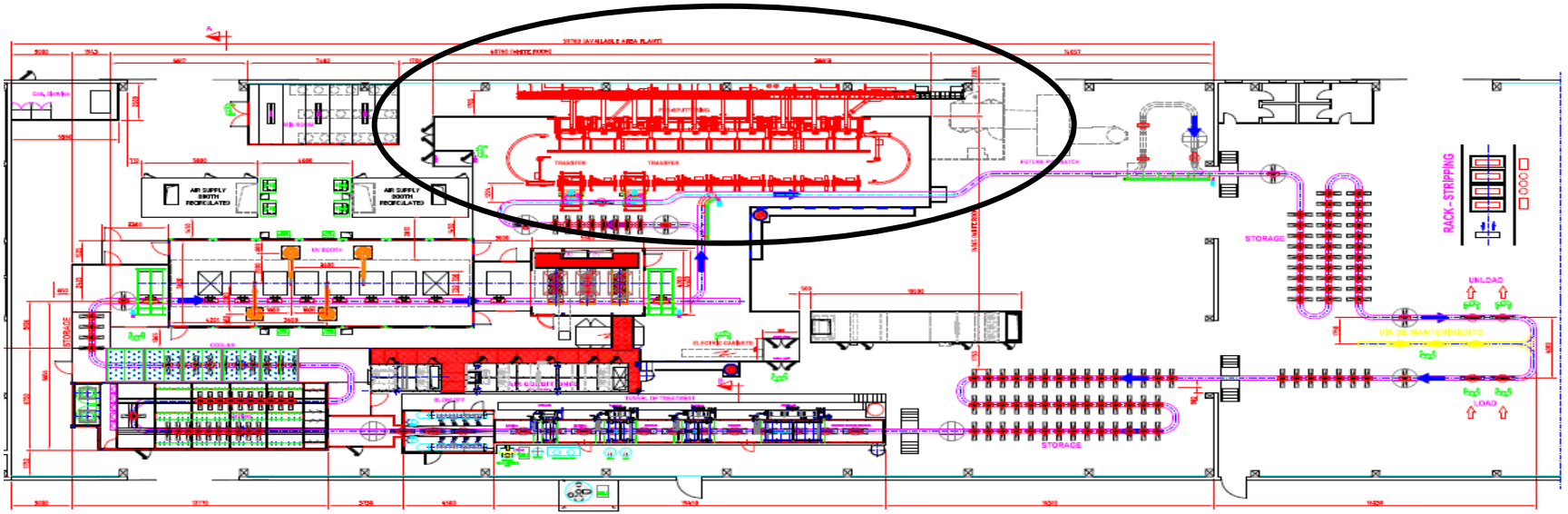
Sputter two sided



PACVD with rotation

Microwave

Factory lay-out



Plant layout with Metalliner fully integrated in a PVD/lacquer-production line
Full traceability of racks (components)

Thank you for your attention

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