DECORATIVE PLASTIC METALLISATION WITH ADDITIONAL FUNCTIONALITIES
ePD: TECHNOLOGY AND COATING SYSTEMS
The technology of plastic metallisation has attracted the attention of designers and important industrial sectors for many years. Consumer products featuring components with a shiny metallic look are fashionable and raise their perceived value. Increased environmental awareness has led scientists and engineers to develop alternative surface technologies and coatings. These solutions are required to have comparable visual and protective properties, but with less or no environmental impact. Oerlikon Balzers has developed ePD™ (embedded PVD for Design Parts); a surface technology that not only provides the glossy look of metal – the most popular being chromium – but also meets the high protective requirements that a coating needs to deliver. In addition, new functionalities can be integrated into the decorative surface. With ePD™ and the INUBIA I coating systems, Oerlikon Balzers supplies a complete high-tech solution for plastic metallisation. With its fully integrated process management, INUBIA I allows an economical large-scale production.

**Common metallic car exterior attachments**

**Radiator grill:**
- Chrome effect (gloss, matt)
- Backlighting
- Radar transparency
- Dark chrome

**Wing mirror cover:**
- Integrated antennas
- Optical illumination

**Door handles:**
- Radar transparent components for keyless systems like NFC technology
- Backlighting

**Radar-transmitting badges:**
- „Radome“
ePD™ allows transmission of ACC (Active Cruise Control)
Radar systems behind decorative surfaces with a chrome look.

**Trim strips:**
High corrosion resistance ("Russian Mud" test)

**Bumper trim:**
The flexible ePD™ coating allows straight trim components to be produced and then shaped during assembly.
ePD TECHNOLOGY
METALLISATION OF DESIGN ELEMENTS WITH A METALLIC LOOK

Inspiring coatings
ePD™ is the abbreviation for “embedded PVD for Design Parts”. It is an environmentally friendly, future-oriented coating process. Whenever high-quality metallic surfaces are required on plastic components, ePD™ offers an alternative to conventional production technologies and expands the range of products. No environmentally harmful chrome derivatives are used in the ePD™ process.

What is ePD?
ePD™ based coatings consist of three layers: a primer, a thin metallic decorative film and a top coat. The primer serves to even out irregularities in the injection moulded plastic substrate. A thin metallic decorative film is applied on the top of the base coat using PVD technology (metallisation in a vacuum).

Another paint layer is applied for protection and to ensure the correct gloss level. The ePD™ process produces very low emissions and uses few resources. ePD™ coated products are recyclable.
Range of colours
Beyond the classic chrome colour, ePD™ offers a large variety of colour options, from mirror chrome and graphite chrome to many other colour shades.

Eco-friendly
ePD™ is the environmentally friendly alternative to conventional production technology. No chrome derivatives are used in the process. ePD™ coated parts are recyclable.

Corrosion resistance («Russian Mud» test):
ePD™ based coatings provide enhanced corrosion resistance exceeding the «Russian Mud» test – this is an important property for metallised plastic components on the exterior of vehicles, which are exposed to ever higher numbers of chemicals.

Safety characteristics
ePD™ coatings applied to soft and flexible base materials do not cause sharp edges when fractured. The coated components outperform safety requirements in car interiors and open up new horizons in the design of automotive exterior components (e.g. pedestrian protection).

TRANSLUX® – transparent or translucent on closed surfaces
ePD™ based coatings can be designed to allow light to pass through so that light sources located underneath are visible. Components with a metallic, glossy or matt look can be fitted with individual ambient or signal lighting.

Day/night design – laser processing on interrupted closed surfaces
Laser processing allows controlled removal of the coating so that symbols can be illuminated.

Contact sensors
ePD™ based coatings allow the use of capacitive sensors on metallised components, meaning that attractive design solutions can be created for all kinds of electronic devices.

Radar transparency
ePD™ technology allows non-corroding surfaces to be manufactured with a metallic appearance, permitting electromagnetic signal transmission. This opens up new design possibilities, e.g. on the front end of a car.

Suitable for a wide range of substrate materials
ePD™ is not restricted to PC/ABS and ABS substrate materials, which gives even more flexibility in design and engineering. ePD™ allows many other polymers such as PC, TPE, PA and ASA to be metallised. For example, a flexible material can be metallised and bent or rotated to a certain degree without fracturing.

ADDITIONAL POTENTIAL FOR COST SAVINGS
ePD™ allows a high-quality metal look to be created by using coatable surfaces and plastics to which paint can be applied, without requiring new or additional tools.
INUBIA I6 and I15 are user-friendly, large-scale production systems for ePD™ based coatings. The integrated system, developed by Oerlikon Balzers, enables fully automated production in accordance with automotive specifications.

The INUBIA B6.1 batch system is specifically designed to allow small production runs or product developments. The synchronised process management and system technology enables a subsequent transfer to INUBIA I inline systems.

<table>
<thead>
<tr>
<th></th>
<th>INUBIA B6.1</th>
<th>INUBIA I6</th>
<th>INUBIA I15</th>
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<tbody>
<tr>
<td>System type</td>
<td>Batch</td>
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<tr>
<td>Spindle length</td>
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<td>Process time per spindle</td>
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<td>&lt; 40 sec.</td>
<td>&lt; 50 sec.</td>
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</table>
CO₂ cleaning
Application of the base coat through spray painting
Magnetron sputtering of the metallic or metal-ceramic thin PVD film
Application of top coat to protect the metallic film and adjust the gloss level
Manual or automatic unloading of the spindle

PVD (Magnetron sputtering):
Physical vapour deposition (PVD) is a vacuum-based method for depositing specific metals using plasma (magnetron sputtering). With the INUBIA range, Oerlikon Balzers has developed a low-temperature process specifically for temperature-sensitive materials (such as plastics) which enables PVD coatings between 20 and 500 nm thick to be deposited.

Inline PVD process:
Multi-chamber short-cycle system for processes, which last just a few seconds; modular design to meet customer requirements.

Inline UV painting:
Synchronised painting process with UV paint and optional CO₂ pre-cleaning.
**ePD SYSTEMS: INUBIA I**

**SYSTEM DESIGN FOR FLEXIBLE COMPONENT SIZES AND QUANTITIES**

<table>
<thead>
<tr>
<th>smart</th>
<th>complete</th>
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<tbody>
<tr>
<td><img src="image1.png" alt="Smart System Design" /></td>
<td><img src="image2.png" alt="Complete System Design" /></td>
</tr>
</tbody>
</table>
| - Initial set-up  
- Can be expanded by adding a second painting line | - Maximum production capacity  
and unit cost efficiency |

Two standard system designs are available for component sizes with a length of 600 mm or 1500 mm.

The INUBIA I platform allows a phased introduction of the ePD technology. The “smart” versions are initially restricted to a coating system which applies the primer and then the top coat.

With the smart arrangement, the second painting system can be installed at a later time without significantly impairing production. This installation increases the output capacity and maximises the efficiency. It also allows an incremental investment.
The PVD multi-chamber coating system combines the advantages of short-cycle coating with the opportunity for complete automation. The modular design allows the system to be set-up to meet customer-specific product requirements.

**System versions**
- INUBIA H6: 600 x 220 mm spindle size
- INUBIA H15: 1500 x 360 mm spindle size

**Spindle compatibility**
- Spindles are compatible with the INUBIA P6/P15 paint lines

**Set-up**
- Horizontal spindles
- 2 spindles per carrier

**Efficiency**
- Synchronised process management for the INUBIA P paint line
- Cycle times from 35 seconds per spindle for H6 and 45 seconds for H15

**Flexibility**
- Stand alone system or integratable
- Complete modular chamber system
- Variable number of coating chambers
The INUBIA P systems are designed to perfectly pair with the INUBIA PVD systems. A key advantage are the low process temperatures at high UV energy density. The compact design requires minimal space for installation.

**Spindle compatibility**
- Spindles are compatible with INUBIA H6/H15 and INUBIA B6 PVD systems

**System versions**
- INUBIA P6: 600 x 220 mm spindle size
- INUBIA P15: 1500 x 360 mm spindle size

**Technology**
- Application system for single-component monocus UV-Lacquers

**Efficiency**
- Synchronised process management for the INUBIA H PVD systems
- Cycle times from 35 seconds per spindle for P6 and 45 seconds for P15

**Options**
- Integrated CO₂ cleaning
- Paint collection module

**UV painting process sequence**
CO₂ → ESD → Paint application → Flash Off → UV curing
The INUBIA B6 PVD coating system is a planar magnetron sputtering system, which enables both reactive and non-reactive plastic metallisation processes to be carried out. The intelligent combination of different plasma-sources and process-gases allows thin-film coatings with various decorative and functional properties to be deposited.

**System versions**
- INUBIA B6: for development
- INUBIA B6: for production

**Spindle compatibility**
- Spindles are compatible with the INUBIA P6 paint line

**Transferability**
- The PVD batch processes can be transferred to the INUBIA inline systems (H6, H15)

**Flexibility**
- Access to the process chamber from three sides increases flexibility
- Different options for process development or process management

**Efficiency**
- A large coating chamber, short process steps, user-friendly process software and the option for remote control – all improve efficiency.
Rely on Oerlikon Balzers specialists to support you in the equipment and production concept: from start of layout until series production.

- Project planning
- Consultation
- Concept layout
- Process implementation
- System training
- System maintenance and technical support
Customer service
Our global service and engineering teams provide customer support on site and carry out remote maintenance.

Eco-friendly technology
The ePD™ process is REACH-compliant and uses no Cr 6+ in the production process. Metallised parts can be disposed of easily or recycled.

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