METAL STRIP COATING SYSTEMS
ADVANCED COATING EQUIPMENT
OUR STRENGTHS IN METAL STRIP COATING

VON ARDENNE is a leading manufacturer of metal strip coating systems. These systems are modularly designed, flexible production tools for thin-film coatings. With the unique combination of our different technologies, highly reflective, highly absorbing and decorative coatings can be created. Furthermore, contact layers or layers to improve corrosion protection can be deposited for a wide range of applications.

ANTI-CORROSION COATINGS
Zinc and/or magnesium can be efficiently evaporated on both sides of steel strips using PVD technology. This technology can be used in addition to existing hot dip galvanizing (HDG) or electroplating processes or even replace them altogether. By using ZnMg PVD coating, the corrosion protection can be improved or the thickness of the coating layer thickness can be reduced.

DECORATIVE COATINGS
Decorative coatings on metal strip create surfaces that look and feel like high-quality metal at minimum process costs. A wide range of colors can be created, either as surface-colored layers or interference-colored layers. Functional properties can be achieved as well such as protection against corrosion, abrasion and scratches.

FUNCTIONAL COATINGS FOR FUEL CELLS
Multiple deposition technologies can be applied on stainless steel substrates to improve the corrosion resistance, minimize the interfacial contact resistance, and to increase the electrochemical stability and the mechanical adhesion of bipolar plates. They are a key component of fuel cells.

HIGHLY REFLECTIVE MIRRORS - LIGHTING INDUSTRIES
Reflector systems based on highly reflective aluminum or silver allow for maximum light distribution and reduced energy consumption (~20%) using the same light output.

HIGHLY REFLECTIVE MIRRORS - CONCENTRATED SOLAR POWER (CSP)
CSP systems generate solar power by using highly reflective mirrors (HRM) to concentrate a large area of sunlight, or solar thermal energy, onto a small area. Electricity is generated when the concentrated light is converted to heat, which drives a heat engine (usually a steam turbine) connected to an electrical power generator.

FLEXIBLE PHOTOVOLTAICS
The deposition of functional layer stacks for thin-film photovoltaics on metal strip allows for manufacturing flexible building-integrated photovoltaics (BIPV) modules. The integration of flexible PV sheets into roof elements for buildings improves their environmental impact and has a positive aesthetic effect too.

SOLAR ABSORBERS
Metal strip with an absorber coating is used in flat and pressurized tube collectors. They are a centerpiece of solar thermal collectors and absorb sunlight at high efficiency and heats a fluid, which is usually water. Main applications are the heating of buildings and domestic water heating or cooling if used in connection with an adsorption chiller.

PRINTED CIRCUIT BOARDS
The surface of copper strip is coated and then further processed to create special printed circuit boards (PCB).

IN-HOUSE TECHNOLOGY & APPLICATION CENTER
— Product & process verification and optimization
— Sample coatings of customer applications
— Development of customized layer stacks

CLOSE PARTNERSHIP
We cooperate with the Fraunhofer Institute for Organic Electronics, Electron Beam and Plasma Technology (FEP).

PROFESSIONAL SIMULATION SUPPORT
We offer state-of-the-art software tools for the simulation of processes and performance.

GLOBAL PROJECT EXPERIENCE
We have delivered and assembled our equipment in more than 50 countries.

COMPREHENSIVE SERVICE PORTFOLIO
— Training tailored to customer requirements
— Supporting customer operation processes
— Equipment optimization
— Preventive maintenance of the equipment
— Troubleshooting
— Technical audits

UPGRADE OF EXISTING EQUIPMENT
We can upgrade your existing systems with new components and application technology.

With more than 55 years of experience in electron beam processes and over 40 years of know-how in vacuum coating, VON ARDENNE is one of the leading providers of equipment and technologies in PVD thin-film technology and vacuum process technology. We are able to turn product property requirements into efficient and competitive coating solutions, which is an essential precondition for individual machine concepts.
KEY FEATURES AND PARAMETERS

**COATER TYPE**

**AIR-TO-AIR**
- Entry and exit sections are equipped with dynamic lock roller systems to enable uninterrupted strip movement
- Strip buffer, joining and separation units as well as coilers and uncoilers are placed before and after the coater on atmosphere for continuous production
- Production campaign time is only limited by target / evaporant storage volume inside the vacuum section

**BATCH**
- Coil load lock chambers at entry and exit of vacuum process section, to be separated with strip valve
- Coils can be loaded and unloaded without interrupting the process vacuum
- Production campaign time is 1 coil, then stop for coil exchange, strip waste approx. 2x length of process section
- EB process is equipped with additional shutter to compensate for the coil exchange

**COATING MODE**

**SINGLE-SIDED COATING**
- All coating tools are arranged on one side of the strip
- When using electron beam (EB) process, the bottom side of the strip is coated (usually)

**DOUBLE-SIDED COATING**
- No major concept change necessary when using sputtering process only
- When using EB, a two-level machine is necessary

**TOUCH-FREE COATING OPTION**
For sensitive optical coatings, a touch-free machine concept is available.

**STRIPE MATERIAL**

**ALUMINIUM**
- Remark: other metals on request

**COPPER**

**STAINLESS STEEL**

**CARBON STEEL**

**STRIPE WIDTH**

<table>
<thead>
<tr>
<th>Minimum</th>
<th>Maximum</th>
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<tbody>
<tr>
<td>100 mm</td>
<td>2000 mm</td>
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**STRIPE THICKNESS**

<table>
<thead>
<tr>
<th>Minimum</th>
<th>Maximum</th>
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</thead>
<tbody>
<tr>
<td>0.1 mm</td>
<td>2.0 mm</td>
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**STRIPE SPEED**

<table>
<thead>
<tr>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1 m/min</td>
<td>100 m/min</td>
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**ANNUAL PRODUCTIVITY**

- up to 10 million m² coated surface (one side)
- up to 1 million t steel strip

**TECHNICAL DATA**

**AIR-TO-AIR SYSTEM FOR NARROW SUBSTRATES**
Air-to-air metal strip coater consisting of lock systems, plasma pre-treatment and coating chambers, installed in a multifunctional coating line.

**TECHNICAL DATA**

- **Coater type**: air-to-air
- **Coating mode**: single-sided coating
- **Strip material**: stainless steel, carbon steel
- **Strip width**: 300 mm
- **Strip speed**: ≤ 60 m/min
- **Strip thickness**: 0.3 mm to 0.7 mm

**FLEXIBLE BATCH SYSTEM**
Batch-type metal strip coater with variable pre-treatment and coating stations, flexible strip guidance for single-sided and double-sided coating, and reverse mode operation.

**TECHNICAL DATA**

- **Coater type**: batch
- **Coating mode**: single-sided coating & double-sided coating
- **Strip material**: aluminium, copper, stainless steel, carbon steel
- **Strip width**: 300 mm
- **Strip speed**: ≤ 60 m/min
- **Strip thickness**: 0.3 mm to 0.7 mm

**HIGH-VOLUME SYSTEM FOR WIDE SUBSTRATES**
High-volume production coater that uses the air-to-air process from coil to coil and that can be continuously operated for up to 120 hours.

**TECHNICAL DATA**

- **Coater type**: air-to-air
- **Coating mode**: single-sided coating
- **Strip material**: aluminium, copper, stainless steel
- **Strip width**: 900 mm to 1250 mm
- **Strip speed**: up to 20 m/min
- **Strip thickness**: 0.2 mm to 0.8 mm

We have gained considerable process expertise from developing and delivering numerous industry-proven metal strip coaters during the last 25 years. Thanks to this know-how, we are able to offer custom-made solutions based on standardized components.
The success of our metal strip coating platform rests upon its highly flexible and broad configuration range, our technological experience and know-how, and the key components developed and manufactured by VON ARDENNE.

Depending on the required platform configuration, a VON ARDENNE metal strip coater may include some or even all of these components:

Strip lock systems, plasma pre-treatment, magnetrons for sputtering, inline measurement and process control system, electron beam evaporation, and thermal evaporation. Due to the modular concept of all our metal strip coaters, these components can also be provided as upgrades or retrofits after the initial installation of the equipment.

VON ARDENNE KEY COMPONENTS

VON ARDENNE can supply different types of thermal evaporators, mainly for evaporating metals with lower melting temperatures, such as magnesium.

Boat evaporators are available for systems with low productivity and R&D coaters. They are distributed over the strip width to achieve the requested coating homogeneity.

Jet evaporators are suited for coaters with a high productivity. They produce a directed stream of a gaseous evaporant directed through a hot channel or distributed by nozzles across the strip width. The hot channel version allows a utilization of up to 90 percent of the evaporant deposited on the strip.

VON ARDENNE develops and manufactures electron beam systems which are used for the high-rate evaporation of metals, alloys and compounds in our metal strip coaters. The first electron beam gun was developed in 1960 at the Manfred von Ardenne Research Institute. Our more than 55 years of experience are reflected in over 400 electron beam systems installed worldwide.

Each evaporation chamber of our metal strip coating systems is usually equipped with two electron beam guns which are used

- as energy sources for the evaporating process. The guns generate electron beams of high power density which are shot onto the evaporation crucible units.
- to heat up the evaporant which is filled into the crucible. The crucible is on the bottom of the chamber.
- for highly productive coating systems. They offer up to ten times higher evaporation rates than magnetron sputtering.

Electron beam crucibles:

Different crucible types are available. They are mounted on the inside of the evaporation chamber door and are suited for metals, melting and subliming oxides.
VON ARDENNE develops and manufactures industrial equipment for vacuum coatings on materials such as glass, wafers, metal strip and polymer films. These coatings give the surfaces new functional properties and can be between one nanometer and a few micrometers thin, depending on the application.

Our customers use these materials to make high-quality products such as architectural glass, absorbers and absorber tubes for solar-thermal power plants, reflectors for lighting systems, displays for smartphones and touchscreens, solar modules and heat protection window film for automotive glass.

We supply our customers with technologically sophisticated vacuum coating systems, extensive expertise and global service. The key components are developed and manufactured by VON ARDENNE itself.

Systems and components made by VON ARDENNE make a valuable contribution to protecting the environment. They are vital for manufacturing products which help to use less energy or to generate energy from renewable resources.