

METALLIC BIPOLAR PLATES

VACUUM COATING
EQUIPMENT & TECHNOLOGIES

Minimize your manufacturing costs
with highly productive coating solutions
for metallic bipolar plates

MINIMIZE YOUR MANUFACTURING COSTS

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As a manufacturer of bipolar plates for PEM fuel cell systems and electrolyzers, you are faced with the challenge of meeting the needs of a growing market. In addition, you have the task of raising the industrialization of your processes to a new level.

We offer you ideal solutions for cost-effective and highly productive manufacturing, tailored to your current and future requirements.

Our coating systems are based on platforms that allow you to scale from research and development to large-scale production.

Advantages of bipolar plate coating

Bipolar plates should be as durable, conductive and cost-effective as possible. To meet these requirements, metallic bipolar plates are coated with functional layers. PVD technologies are typically used for this purpose.

For the PEM fuel cell, we went one step further and developed and validated our own carbon-based layer stacks. The aim was to meet the demanding range of requirements for bipolar plate coating in an optimal and scalable way and to set new standards.

We will support you from the research and development phase to the establishment of an industrial coating solution for bipolar plates.

Corrosion protection & long lifetime
through electrochemical & mechanical resistance

Improved conductivity
due to reduced interfacial contact resistance (ICR)

Scalable processes
from R&D to mass production at low cost of ownership



SCALABILITY = PRODUCTIVITY



COATINGS FOR METAL STRIP & BIPOLAR PLATES

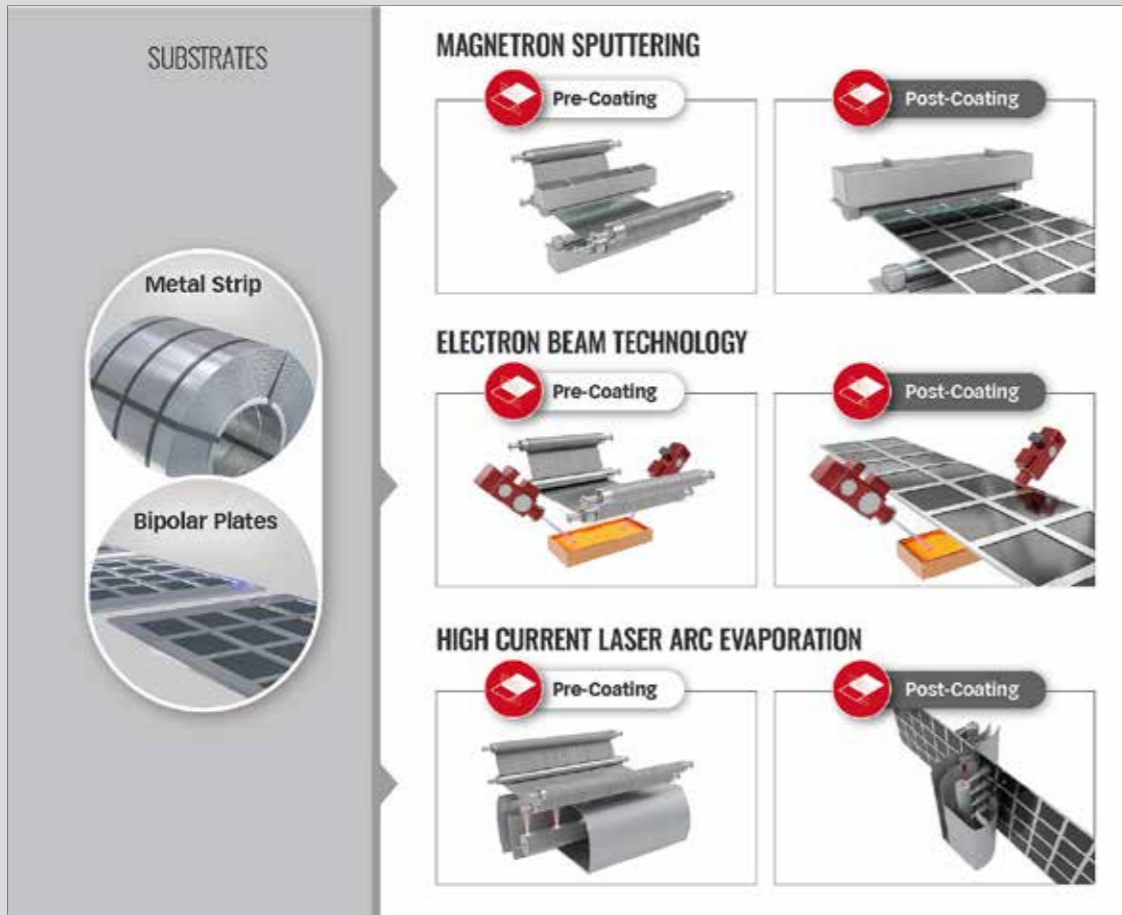
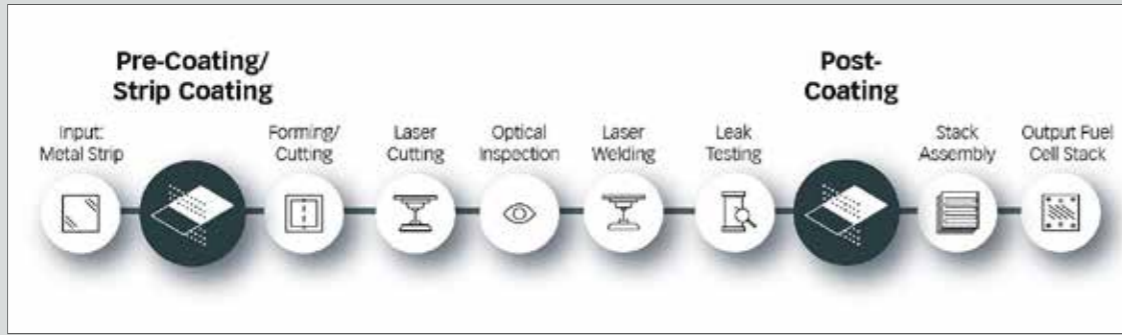
To offer you optimal pre- and post-coating solutions, we combine our equipment and PVD technology portfolio.

Pre-coating describes the coating of metal strip straight from the coil and focuses on high productivity at unrivaled low cost.

Post-coating, on the other hand, is a more conservative coating approach. Here, completely welded bipolar plates are coated on both outer surfaces while avoiding any interaction of the coating with the forming and welding process.

A third alternative is **mid-coating**, which means that anode and cathode halfplates are coated on both sides after the forming process but prior to their assembly into a bipolar plate.

Process chain & process modalities



For the coating of PEM fuel cell and electrolyzer bipolar plates, we can provide a wide range of PVD equipment - from standardized platforms to individual solutions that are tailored to your needs. This portfolio ranges from R&D over pilot to high-volume production equipment for the coating of strip material (roll-to-roll, R2R) and plates (sheet-to-sheet, S2S).

In addition, we offer to discuss your coating requirements with you and to adapt our coater concepts to perfectly match your plate designs and production volumes. Beyond that, we can calculate the total cost of ownership for you.



MSC500
Metal Strip Coating System



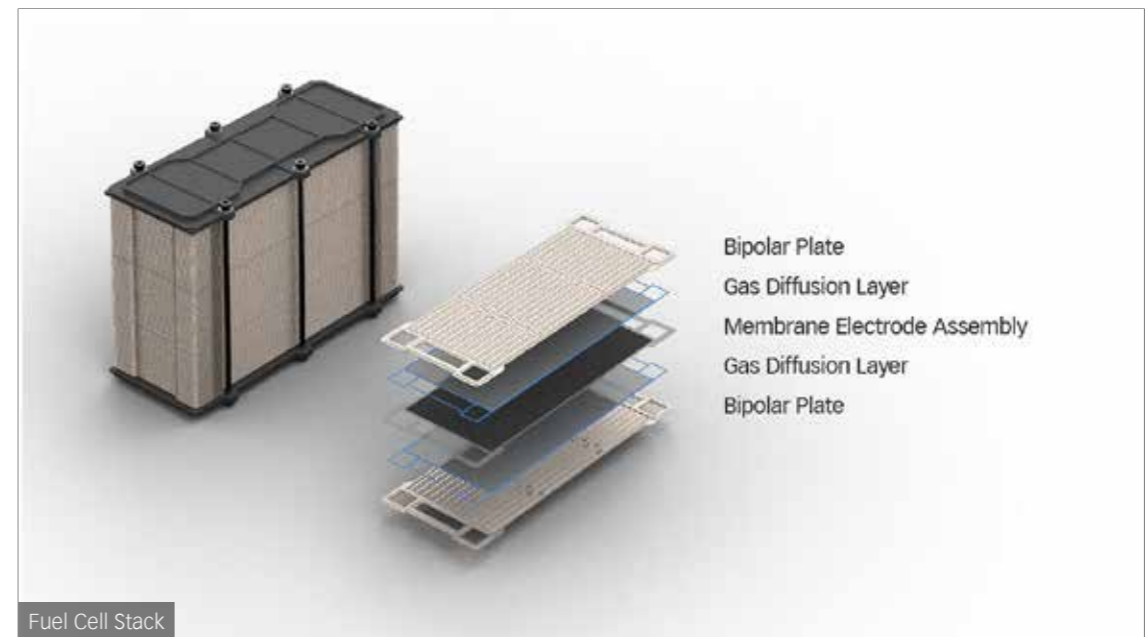
HISS
Horizontal Coating System



MSC1250
Metal Strip Coating System



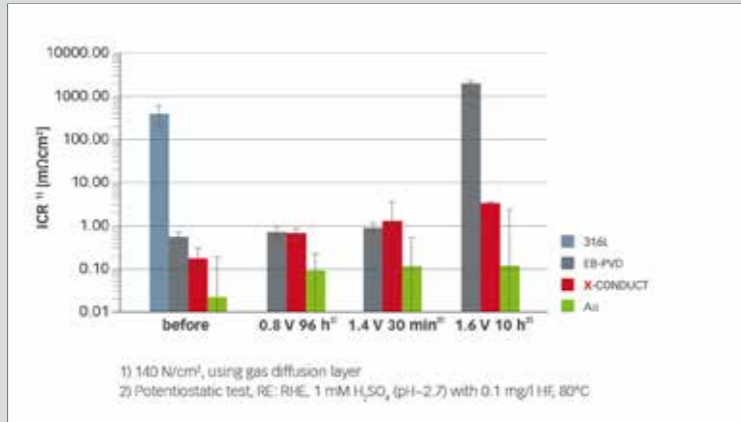
VICA
Vertical Coating System



COATINGS FOR PEM FUEL CELLS

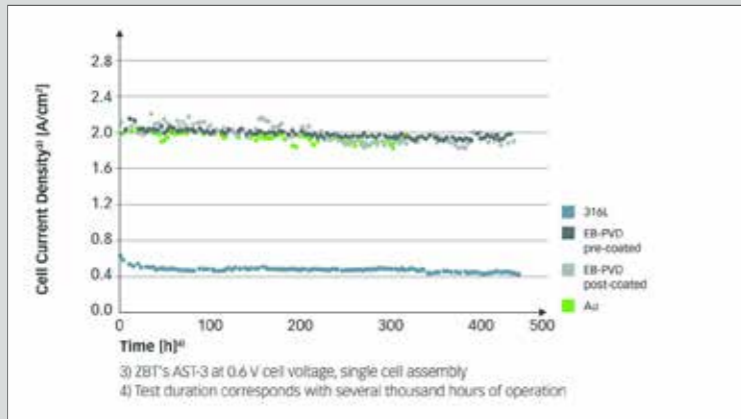
Our carbon-based layer stacks for PEM fuel cell applications are optimized for a low interfacial contact resistance (ICR), good adhesion and high corrosion resistance. The ICR, corrosion performance and durability of these layer stacks are comparable to the gold reference coating and have been qualified by renowned research and testing institutes. In this context, our carbon coating called X-CONDUCT clearly outperforms comparable solutions.

Electrochemical corrosion test with Fraunhofer ISE



VON ARDENNE carbon coatings are corrosion resistant at fuel cell potential. Even after exposure to higher potentials, they show low contact resistance, similar to a gold coating. Especially X-CONDUCT demonstrates excellent corrosion resistance.

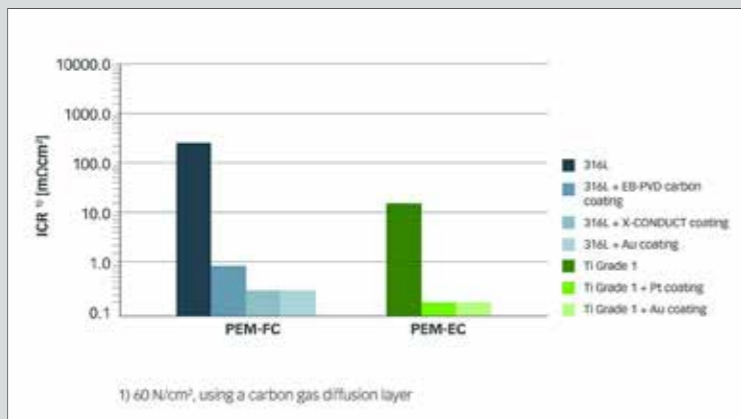
Accelerated stress test (AST) with ZBT



In the accelerated stress test, the performance of VON ARDENNE coatings (pre- and post-coating) can also reach the performance of a PVD gold coating.

COATINGS FOR PEM ELECTROLYZERS

VON ARDENNE also offers noble metal coatings for PEM electrolyzer applications. These coatings reduce the interfacial contact / through-plane resistance (ICR/TPR) and provide corrosion protection at the anode potential of the electrolysis. They also serve as a barrier against hydrogen embrittlement.



JOINT TESTING, SAMPLING & IMPROVEMENT

from simulation to pilot production



Sampling & Layer Development

At our Technology & Application Center (TAC), we work together with you on the next generation of your coating applications.

From the simulation of layer stacks and their functionality, to sample production on a laboratory and pilot scale, to the measurement and evaluation of coating and substrate properties: We are prepared to meet a wide range of requirements.


This gives you the opportunity to test the function of the coating for your product in advance on relevant sample sizes.


- Gaining knowledge through simulation of layer composition & properties ✓
- Risk reduction & quicker market maturity through industrial trials ✓
- Individual access to a variety of coating materials & services ✓
- Optimal equipment configuration through testing in a scalable process ✓



- Sampling & qualification of properties from a single source
- Developing layer systems customized to customer requirements
- Sampling customer-specific layer systems
- Qualifying & industrializing layer systems together with customers
- Measuring & testing according to industry-specific requirements
- Coating services for pilot production

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OUR STRENGTHS

In-House Technology & Application Center

- Sample coatings of customer applications
- Development of customized layer stacks
- Product & process verification and optimization
- Testing of new technologies and components

Professional Simulation Support

We offer professional simulation technology to ensure best process quality with regards to plasma, heat and cooling. Furthermore, our simulation tools help demonstrate, develop and improve layer properties and define or optimize processes, details and the performance of our systems.

Close Partnership

VON ARDENNE has a network of partners for even more profound R&D work and to identify future technologies. It consists of:

- Fraunhofer Institutes
- Institutes of the Helmholtz Association
- Universities
- Companies

Global Project Experience

VON ARDENNE equipment is used in over 50 countries. We have established an installed base of hundreds of coating systems worldwide, ranging from small tools to equipment for large-area coating applications for several markets.

Comprehensive Service Portfolio

- VON ARDENNE service hubs around the world
- On-site service
- Remote access by our technology department
- Regular technical and technological trainings
- Spare & wear part warehouse close to customers
- Lifecycle extension of wear parts

Upgrades & Retrofits

As soon as your business is growing, your VON ARDENNE equipment will grow accordingly - thanks to its modular design and the upgrades we provide. We will also supply you with the necessary technology upgrades if you decide to change your applications.

Furthermore, when your equipment is ageing, we will retrofit your systems with new components, no matter if they are VON ARDENNE or third-party machines.

WHO WE ARE & WHAT WE DO

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, 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.

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