

Coatings for Electrolyzers and Fuel Cells



Hydrogen production by means of splitting water with electrolyzers is an environmentally benign, efficient, and scalable process. If the electrolyzer is moreover powered by electricity that was generated from renewable energy, a carbon-free production of “Green Hydrogen” becomes possible which will be an important energy carrier in the near future. Electrolyzers that involve a Proton Exchange Membrane (PEM) are compact and can react quickly to load fluctuations. This makes them attrac-

tive for the integration with dynamic energy sources such as wind and solar. One of the most important drawbacks of the PEM technology is their need for implementing expensive precious metals, for example platinum, that serve as catalyst and are used as protective coating with good electrical conductivity on so-called Porous Transport Layers (PTL) and Bipolar Plates (BPP). Adoption of thin film coating technology can serve as part of the solution.

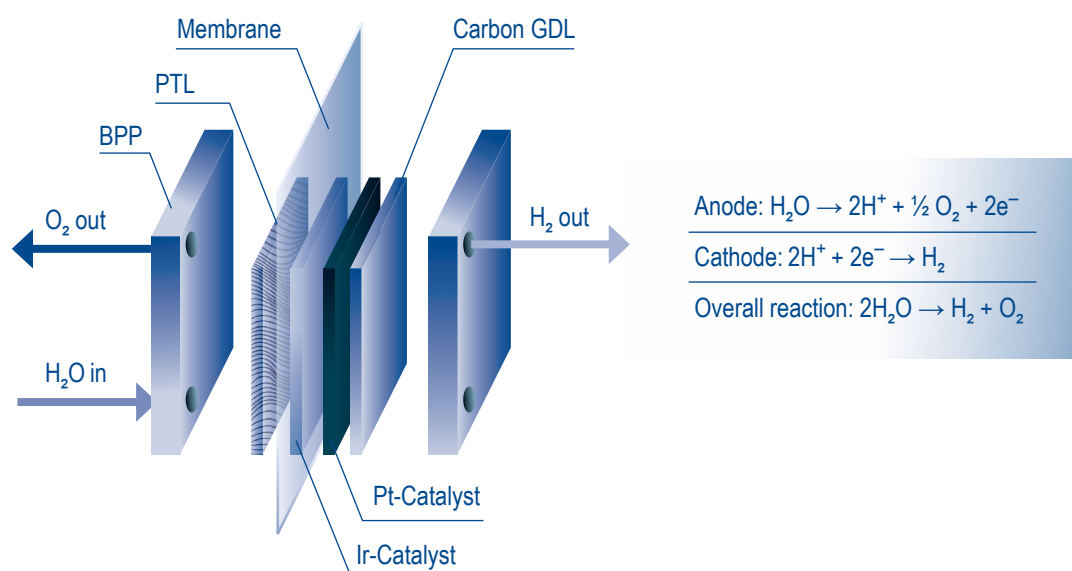


Figure 1 Schematic illustration of a PEM electrolysis cell with its basic components (GDL = Gas Diffusion Layer) and the chemical reactions that take place.

Key to further economization of PEM electrolyzers is cost reduction. This can be achieved by the reduction of the precious metal proportion. Applying noble platinum on BPP's and PTL's by magnetron sputtering - instead of state-of-the art wet-chemical processes - will allow to significantly reduce the coating thicknesses thus minimizing raw material consumption and will finally make electrolyzer as well as fuel cell production cheaper. Regarding an entirely plasma-based process it has to be mentioned that a substrate precleaning and an undercoat technology can be realized to obtain a durable adhesion of the noble metal deposition to the substrate.

AGC Plasma's demonstration center in Lauenförde, Germany is serving as a hub for coating services, providing customers

with immediate access to these advanced solutions. The production output of the available pilot coaters is scalable at any time, so that even large order quantities can be produced and delivered in a short time. We guarantee flexible and efficient production to meet the needs of our customers. The maximum dimension of samples is currently 1750 mm x 1500 mm.

On the basis of decades of experience in thin film coating process and functional coating development as well as the fabrication of innovative products at industrial scale, AGC Plasma considers to be a competent partner for providing protective platinum coatings on electrolyzer components that possess the required stability to resist the harsh chemical conditions in water electrolyzers.

Beyond offering coating services, AGC Plasma is also manufacturing, installing, and commissioning coating equipment at customer sites, ensuring seamless integration and optimized operation. Further, AGC Plasma can offer custom designed and modular magnetron sputtering equipment. The portfolio ranges from R&D

over semi-industrial to high-volume production equipment for Roll-to-Roll (R2R) coating process in the case of rolled foils, web or textiles and plates via Sheet-to-Sheet (S2S) production. By having a modular equipment design, future upgrades in production capacity are feasible.

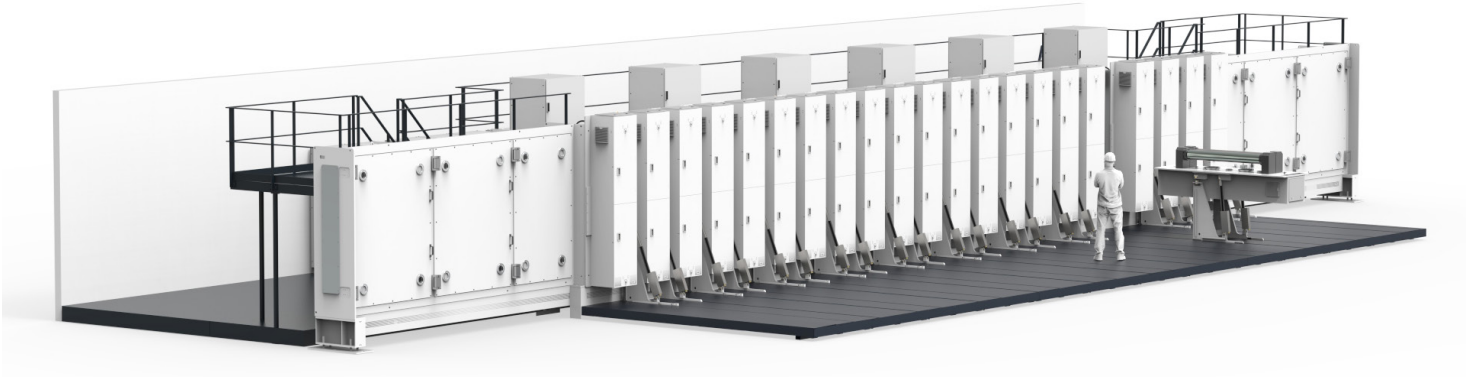


Figure 2 Schematic illustration of an AGC vertical vacuum coating machine with multiple plasma sputter sources being implemented which allows for multi-layered coating fabrication and high-throughput production.

BENEFITS

- AGC offers an industry-proven PVD technology with superior process stability and reproducibility.
- Magnetron sputtering is safe for humans and the environment as it does not require corrosive or toxic chemicals.
- Coating uniformity unmatched in industry with AGC's proprietary Online Shimmable Magnet Bar (iOSMB) technology, reducing production costs.
- Sputtering with cathodes in a vertical position allows for highest-quality coatings with low particle pollution.
- Platinum coating after pre-cleaning and applying an undercoat improves corrosion and oxidation resistance and protects the components against degradation. In addition, platinum reduces the ohmic resistance.

AGC Plasma Technology Solutions is the industrial coatings unit of the world's largest glass producer AGC Inc. (Asahi Glass Company) and a one-stop provider for plasma-based vacuum coating equipment. The group leverages decades of thin-film coating experience on large area glass products to innovate and develop new industrial solutions from proof-of-concept to mass production. AGC Plasma Technology Solutions operates R&D and production facilities across the US, EU, and APAC.

Headquarters

AGC Glass Europe S.A.

Avenue Jean Monnet 4
1348 Ottignies-Louvain-la-Neuve
Belgium

AGC Business Development Americas

11175 Cicero Drive, Suite 400
Alpharetta, GA 30022
USA

www.agc-plasma.com