

# Electrolyzers and fuel cells

Functional surface finishing solutions  
for hydrogen technologies

General Metal Finishing

atotech.com



# Reliable surface finishing solutions for hydrogen technologies

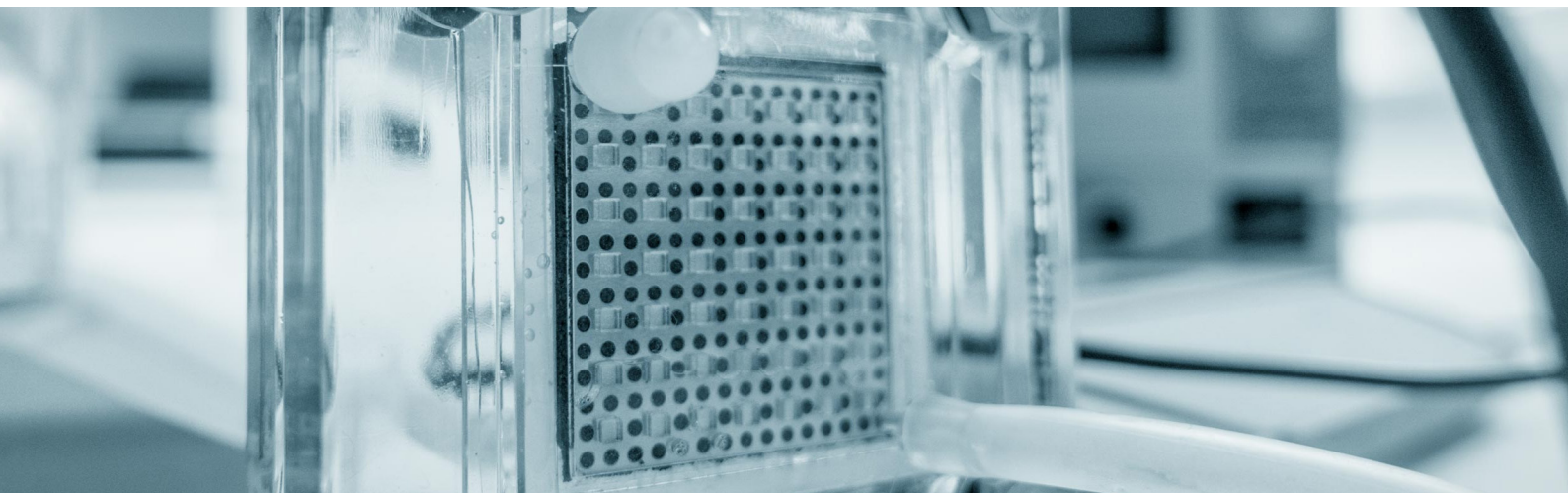
Hydrogen is a promising technology for carbon-neutral energy generation. It boasts a high energy density and generates zero emissions during consumption. Yet in spite of its immense potential, the industry still faces significant challenges when it comes to the production, storage, transport, and utilization of this new technology. Our functional surface finishing solutions help overcome those challenges by providing excellent chemical and corrosion resistance to metal substrates, even in the harshest environments.

Hydrogen generation and conversion systems operating under dynamic and harsh conditions must fulfill the most demanding requirements for reliability, durability, and effectiveness. Factors like freezing, thawing, humidity, or the presence of impurities place stress on the chemical and mechanical stability of the system's materials and components. Meeting such challenging application demands is crucial in facilitating the widespread adoption of hydrogen as a clean energy source.

## Functional surface finishing solutions for reliable hydrogen technologies

MKS supports the hydrogen industry in overcoming the technical challenges posed by generation and conversion technology. Our Atotech pretreatment and plating processes for hydrogen systems provide highly corrosion-resistant metal deposits while supporting electrical conductivity and extending stack life. Our range includes reliable and sustainable metallization solutions, including substrate pretreatment as well as electrolytic nickel, electroless nickel, gold, and platinum processes. Our electroless nickel process features groundbreaking technology that regenerates the bath by removing byproducts and keeping all ingredients in a steady state. This facilitates consistent deposit quality over a potentially unlimited bath life while reducing chemical consumption and waste.

During electrolysis, the electrolyzer system that enables the chemical reaction uses direct electric currents to separate water into hydrogen and oxygen. Depending on the technology used, the bipolar metal plates, which are submerged within the electrolyzer in severely acidic or alkaline conditions, are prone to heavy corrosion, which may negatively impact the system's performance and efficiency. Selecting the right materials is key to preventing corrosion in electrolyzers. That's why alkaline and acidic electrolyzer systems employ high-alloy stainless steels, carbon steels, or titanium, all of which require the corrosion protection that our surface finishing solutions deliver.





## Pretreatment and electroless nickel processes for AWE electrolyzers

Our product portfolio offers high-performance electroless nickel processes for bipolar plates, end plates, current collectors, frames, gas separation tanks ( $H_2/O_2$ ) and fasteners used in alkaline water electrolysis (AWE). These processes reliably provide outstanding quality performance.

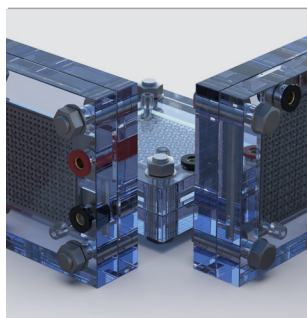
### **Pretreatment processes for all types of substrates:**

Our full range of processes effectively prepares the substrate, providing defect-free surfaces for coatings and ensuring excellent adhesion

**ELeVEN® LP 350:** Low-phosphorus electroless nickel process that provides high corrosion resistance and excellent electrical conductivity

**Nichem® HP 1170:** High-phosphorus electroless nickel process that offers exceptional resistance against corrosive environments

**EDEN® 115:** High-phosphorus electroless nickel process with a long bath life that combines chemistry and technology to maximize quality and sustainability



## Pretreatment and plating processes for PEM electrolyzers and fuel cells

PEM (proton exchange membrane) electrolyzers and fuel cells commonly use bipolar plates manufactured from titanium substrates. The acidic electrochemical environment makes them prone to corrosion, which can affect the service life of the stack. Our gold and platinum processes protect these plates from corrosive environments. Uniform and high-adhesion coatings significantly increase stack lifetime. We are currently exploring development opportunities for cost-effective stainless-steel substrates and alternative coatings to replace the PGM (platinum group metal) for this application.

**Pretreatment:** Our full range of processes effectively prepares the substrate, providing a defect-free surface for coating and ensuring excellent adhesion

**Platinor®:** Platinum plating process designed to provide thin, pure, highly conductive platinum deposits that offer outstanding corrosion protection and improved service life for titanium substrates in acidic chemical environments

**Aurotron® B 100:** Pure gold plating process that provides excellent corrosion protection in acidic chemical environments and features highly conductive ductile layers that are both uniform and thin

# MKS offers a range of sustainable functional surface treatments for the hydrogen industry



## Hydrogen competency

Sustainable high-quality processes, equipment, and chemistry for highly corrosion-resistant surfaces which meet the needs and demands of the hydrogen industry.



## Global presence

Sales and service for our Atotech products in more than 40 countries enable us to provide efficient customer support worldwide. Many of our products are approved by numerous OEMs worldwide.



## Best local service

Our unique global TechCenter network allows us to offer an unmatched spectrum of services, from pilot production, chemical and materials science investigations to comprehensive training for customers and business partners.



## Leading technologies

We collaborate heavily with the entire value chain to seek new paths and set benchmarks for the development of innovative surface finishing processes.



## Production know-how

We provide customers with complete factory design concepts. Our production systems guarantee the highest level of quality and efficiency in wastewater treatment solutions, all at a reduced cost.



## Sustainable solutions

We use less hazardous chemicals whenever possible, eliminate wastewater to the greatest extent possible, as well as reduce our carbon footprint.

