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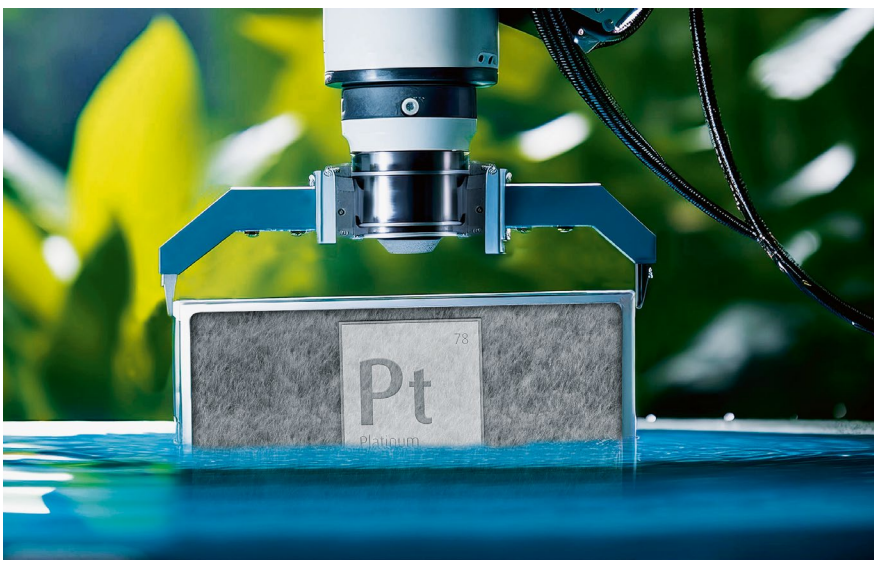
Carbon Coating Gives Tools Longer Service Life

New Platinum Coating Process for Titanium Components

A manufacturer of products and processes for electroplating and PVD coating claims to have developed an environmentally friendly platinum coating process for titanium components in electrolysers. The company aims to use this to ensure more sustainable hydrogen production.

Umicore's Metal Deposition Solutions business unit has developed a new platinum coating process for titanium components in electrolysers. According to the supplier, this technology significantly improves occupational safety during the wet chemical coating of components, as it does not require the highly corrosive or toxic chemicals that were previously necessary. Umicore aims to replace the current standard and ensure more sustainable hydrogen production. The business unit has set up specially equipped production facilities worldwide for this particularly precise and therefore economical coating process.

At a time when the energy transition and the need for sustainable energy sources and storage are becoming increasingly urgent, hydrogen plays a central role as an energy carrier of the future. Among the possible methods of hydrogen production, proton exchange membrane (PEM) electrolysis has established itself as an efficient method. Unlike alternative alkaline electrolysis, which is less flexible in responding to volatile energy quantities (load fluctuations), PEM electrolysis can react quickly to changes in the power supply, making it ideal for integration into renewable energy systems and thus for the production of green hydrogen.



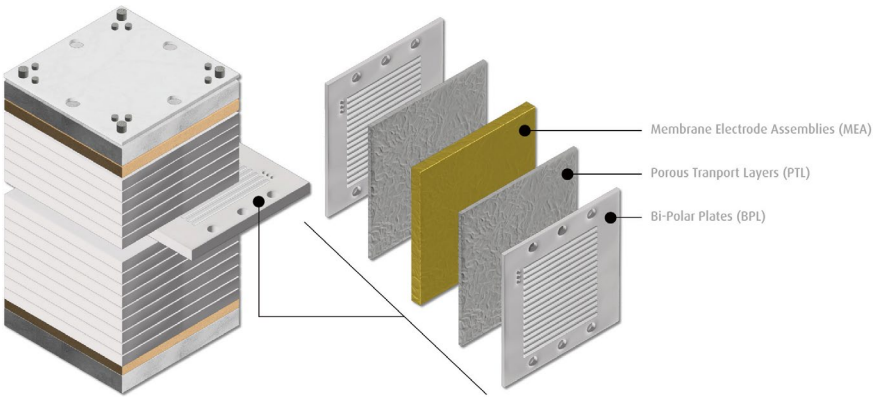
The elimination of hydrofluoric acid makes the platinum coating solution for titanium components a more environmentally friendly alternative compared to previous coating solutions.

Material crucial for PEM electrolyzers

Titanium is used as the base material for the components in order to withstand the demanding conditions of PEM electrolysis. Unlike stainless steel variants of bipolar plates (BPL) and porous transport layers (PTL), titanium is significantly more resistant in the acidic and oxidizing environment of PEM electrolysis. It also helps maintain conductivity and adapt to high-pressure environments, which is crucial for the longevity and cost-effectiveness of the electrolyzers.

Equally important is the platinum coating on the components. On the BPL side, the coating's corrosion resistance further contributes significantly to longevity. Above all, however, platinum improves the performance of the electrolyzers many times over by acting as a catalyst and increasing the efficiency of the electrochemical reactions. It enables a superior electrical potential for the PTL and helps to reduce the amount of energy required for water splitting. This is particularly advantageous when the electrolyzer is powered by renewable energies, enabling the production of green hydrogen.

Titanium is a refractory metal that forms corrosion-resistant oxide layers at room temperature. This property makes it difficult to deposit platinum on titanium BPL and PTL. Therefore, highly corrosive or toxic chemicals such as hydrofluoric acid have traditionally been used for coating in order to break down the passive oxide layers that form on titanium and gener-



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Structure of a proton exchange membrane (PEM) electrolyzer:
Bipolar plates (BPL) and porous transport layers (PTL) made of platinum-coated titanium increase the performance of PEM electrolysis.

ate sufficient adhesion for platinum. Due to its highly toxic and corrosive properties, the above-mentioned hydrofluoric acid can cause serious health problems, including severe burns, eye damage, and breathing difficulties, if it comes into direct contact with the skin or is inhaled. In addition, its use requires strict regulations and special storage containers to ensure the safety of employees and the environment. Together with the additional bureaucratic effort this entails, the use of such substances is no longer compatible with sustainability goals for a growing number of companies.

Expertise for a more environmentally friendly process

In contrast to the conventional hydrofluoric acid process, Umicore says it relies on a specially developed and highly innovative electrochemical deposition process that eliminates the need for such hazardous chemicals for platinum plating. According to the company, Umicore has succeeded in reproducing and scaling a qualitatively equivalent and durable bond between the substrate and the platinum layer under novel process conditions. According to the developers, Umicore's platinum coating is technically mature, and the advanced process also allows very thin, homogeneous platinum layers to be deposited with high precision on titanium components, which achieve the best possible electron conductivity and thus excellent efficiency due to their matrix state. In addition, optimal layer thickness distribution is guaranteed for the respective system.

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The business unit has adapted its electroplating centers worldwide to enable the coating of titanium components for PEM electrolysers to be carried out close to the customer at any time and without long transport routes.

This results in a reduction in the use of precious metals compared to previous coating processes, which in turn lowers costs. According to the company's estimates, this will quickly have a positive impact, especially for large quantities, thus creating the conditions for industrial scalability.

Electroplating centers at key locations

Contrary to its previous business principle, Umicore decided to carry out the coating itself exclusively and not to leave it to its customers via the usual sale of electrolytes. "We decided to take this step due to the complexity of the process and, above all, the space requirements. We see coating – especially in this case – as our core competence and take it on for our customers with the aim of achieving the best possible platinum coating," says project manager Sebastien Fourgeot, explaining the company's rather unusual approach.
Umicore MDS has therefore adapted its electroplating centers worldwide to be able to coat components at any time in relative proximity to customers and thus without long transport routes. These centers are at least partially automated and scalable, so that even large order quantities can be processed efficiently and economically in a short time. //

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