Fraunhofer FEP

PRESS RELEASE

03 | 26

PRESS RELEASE
March 27, 2026 | page 1 / 3

Innovative coating for hydrogen components: Fraunhofer FEP presents further development of titanium coating for composite bipolar plates

The hydrogen industry requires large quantities of reliable and cost-effective components. Bipolar plates in fuel cells and electrolyzers play a central role in this regard. Researchers at the Fraunhofer Institute for Electron Beam and Plasma Technology FEP have further developed an established vacuum coating process so that compact titanium thin films can now be deposited on composite bipolar plates – with good electrical conductivity and corrosion protection, without exceeding the critical temperature limit of the polymer-based composite materials. The research results will be presented from April 8–10, 2026, at the Manufacturing World Nagoya, Japan.

Composite instead of solid titanium: reduce costs, maintain performance

Today, bipolar plates made of titanium are frequently used in PEM electrolyzers and fuel cells. They are corrosion-resistant, but expensive. Composite bipolar plates based on polymer-graphite are considerably more cost-effective and lighter, but require an appropriate protective and functional layer to remain stable and electrically conductive over the long term in the aggressive, acidic environment.

This is where Fraunhofer FEP's work comes in: Building on an already qualified electron beam coating line, a coating approach for composite bipolar plates was developed that combines the material advantages of composite materials with the functional properties of a titanium layer.

Advanced process: dense titanium layer at limited temperature

The coating is performed using plasma-activated electron beam evaporation (EB-PVD with SAD) in a vacuum system. Two requirements had to be reconciled: On the one hand, the titanium layers should be electrically highly conductive and corrosion-resistant; on the other hand, the temperature-sensitive composite material must not be heated above a defined temperature limit during the process.

To achieve this, the established process was adapted to the new substrates, suitable pretreatments were selected for the rough composite surface, and the heat load on the

Federal Ministry of Education and Research

Funded by the German Federal Ministry of Education and Research.
Funding reference: 03SF0647B

Fraunhofer Institute for Electron Beam and Plasma Technology FEP
Winterbergstraße 28 | 01277 Dresden, Germany | www.fep.fraunhofer.de

Head of Communications: Annett Arnold, M.Sc. | Phone +49 351 2586-333 | annett.arnold@fep.fraunhofer.de

plates was carefully controlled. Accompanying measurements and simulations of temperature distribution helped define process windows in which compact titanium thin films with low area-specific contact resistance and effective corrosion protection can be deposited – without exceeding the permissible temperature of the plastic. This provides a scalable approach to make cost-effective composite bipolar plates functional for use in fuel cells and electrolyzers.

"Our investigations demonstrate that composite bipolar plates can be functionally equipped with thin titanium layers in such a way that they become a real alternative to solid titanium plates – while maintaining the temperature limits of the polymers," explains Dr. Stefan Saager, Head of the Coatings for Metals and Energy Technology group at Fraunhofer FEP. "This opens up new prospects for cost-efficient, high-productivity manufacturing solutions in hydrogen technology."

From pilot process to application

This new work builds on previous developments in high-rate coating of metallic foils for bipolar plates and transfers this experience to polymer-based composites. As part of the PolyFoleR project, Fraunhofer FEP, in collaboration with Fraunhofer UMSICHT, developed both the coating process itself and measurement and evaluation methods for electrical conductivity and corrosion behavior under near-practical conditions. This created a toolkit comprising process control, pretreatment, temperature optimization, and characterization, which allows different composite materials to be addressed flexibly. In the future, the achieved results can be transferred to continuous production concepts such as roll-to-roll or sheet-to-sheet lines.

Fraunhofer FEP provides insight into the advances and capabilities of the new process technology at the Manufacturing World Nagoya.

Fraunhofer FEP at Manufacturing World Nagoya 2026

Date: April 8–10, 2026
Location: Port Messe Nagoya, Japan
Booth Number: 5-45

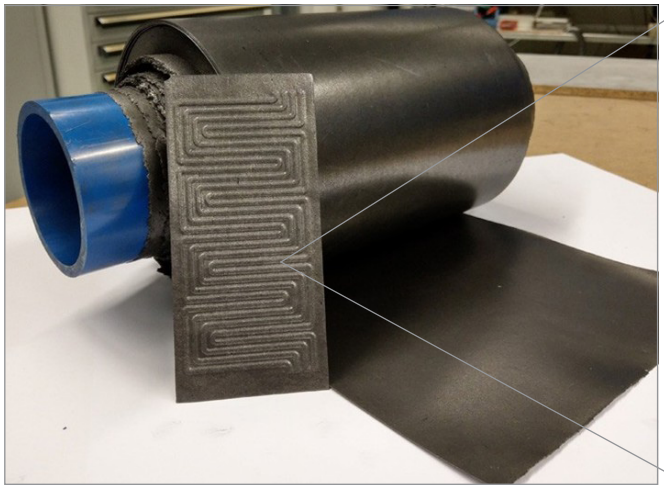
Topics featured at the booth:
- Coated composite bipolar plates for fuel cells and electrolyzers
- Electron beam and plasma technologies for high-rate thin film deposition

About the PolyFoleR Project

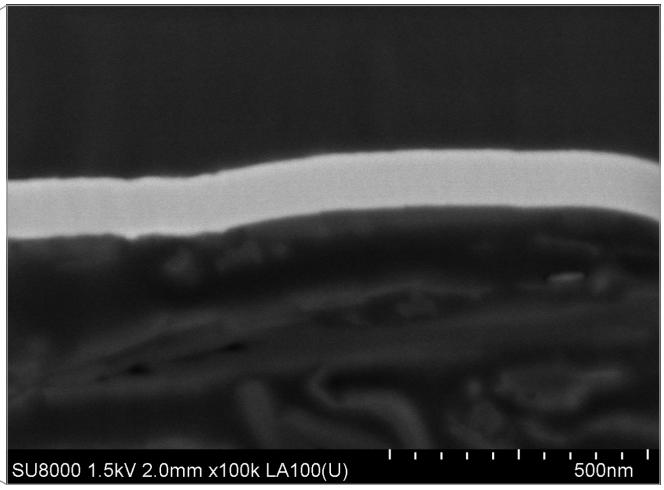
Joint project PolyFoleR: Electrically conductive polymer compound films for electrochemical reactors

Funded by: Federal Ministry of Education and Research (BMBF)
Funding Reference: 03SF0647B
Funding period: October 1, 2021 – September 30, 2025

Project Partners:
- Fraunhofer Institute for Environmental, Safety and Energy Technology UMSICHT
- Schaeffler Technologies AG & Co. KG
- Fraunhofer Institute for Electron Beam and Plasma Technology FEP



Polymer compound film as a base material for the production of cost-effective and high-performance bipolar plates for hydrogen production
© Fraunhofer UMSICHT
Picture in printable resolution: www.fep.fraunhofer.de/press



Titan protective coating with a dense nanocrystalline structure to ensure good electrical contact and excellent corrosion protection
© Fraunhofer FEP
Picture in printable resolution: www.fep.fraunhofer.de/press

The **Fraunhofer Institute for Electron Beam and Plasma Technology FEP** works on innovative solutions for vacuum coating and the treatment of surfaces, liquids and gases. On the basis of our core competencies in electron beam technology, magnetron sputtering and plasma-assisted surface processes, we develop resource-efficient process technologies. These technologies are used in the fields of energy and sustainability, life sciences, environmental technologies, smart building and digitalization. The Fraunhofer FEP offers a wide range of research, development and pilot production options, particularly for surface treatment and refinement. Together with partners, customized, industry-compatible solutions are developed that exploit the innovative potential of future-oriented coating technologies and make them available for the production of tomorrow.