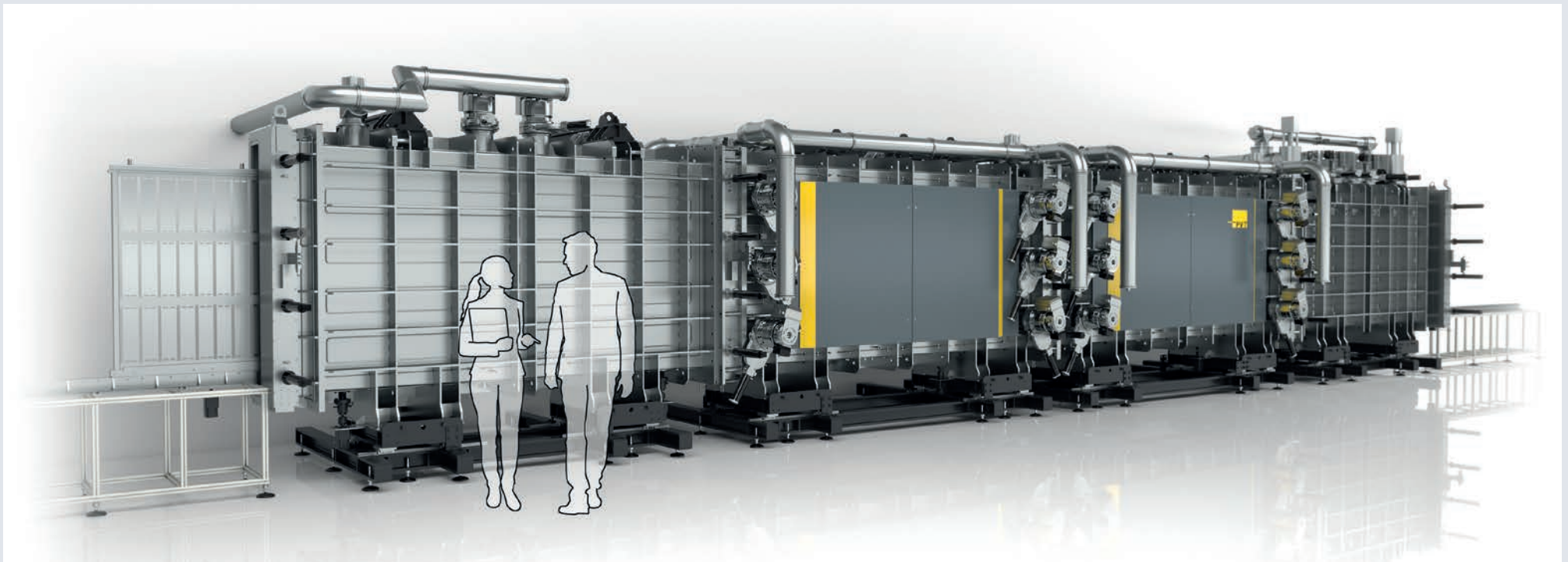


F-CELL IN-LINE COATER



Fuel cells are the driving engine for a CO₂-free future in transportation by cars, trucks, busses, planes, boats or ships. Bipolar plates are an essential part of fuel cells, typically made from thin foils of stainless steel or titanium. The bipolar plates have to be coated to manage their conductivity (ICR*) and corrosion behavior.

Coatings

In the past and for the future several different types of coatings got established or are under development and evaluation:

- Au (gold)
- Metal-nitrides (titanium-nitride and others)
- DLC (diamond-like-carbon in various compositions)

Such coatings can be deposited by PVD (physical vapor deposition) – processes such as:

- magnetron sputtering
- arc evaporation
- PE-CVD
(plasma-enhanced chemical vapour deposition)

Coating equipment

Even though the coatings which are deposited onto the bipolar plates are very thin, cost are the driving factor for coating bipolar plates, i.e. cost have to be < 1 Euro/plate (plate size approx. 750 cm²).

Since both sides of a bipolar plate, typically up to 500 mm x 150 mm, have to be coated a highly productive coating process and coating equipment are essential. Around 300 bipolar plates are compiled in one stack for one single drive unit.

At these numbers batch type systems are no option, since productivity is by far too low.

Systems have to operate in a continuous way, i.e. for mass production of such components the so-called in-line systems are the only option to coat substrates with high throughput from both sides at the same time without rotation.

While the substrates are carried from chamber to chamber separated by large transfer valves the different process steps are carried out in dedicated chambers. The process chambers guarantee a clean environment at very stable vacuum conditions.

PVT developed for this application 2 different types of in-line systems:

- **the i-L 4.3500** and
- **the i-L 3.5000**

In both systems, with 4 respectively 3 chambers, different coating processes can be performed, whether it is magnetron sputtering, arc evaporation or PE-CVD.

The **i-L 4.3500** is a coating system which can coat 5.000.000 bipolar plates / year.

The substrate carrier has a dimension of 3.5 x 1.5 m.

In both systems cost per plate are typically < 1.00 Euro, while depending on the process cost can be even significantly lower.

Other applications

Both systems are designed to coat planar large area substrates, i.e. the frame carrying the substrates can hold substrates up to a planar surface of close to 5 m² and up to 50 mm in the 3rd dimension.

Such substrates can be electrolyzers, mirrors, razor blades and so on.

* ICR = Interface contact resistance

PVT
Plasma und Vakuum Technik GmbH
Rudolf-Diesel-Str. 7 – 64625 Bensheim
Germany

Phone: +49 6251 856560
Fax: +49 6251 8565656
E-Mail: info@pvtvacuum.de
Web: www.pvtvacuum.de