

Advent

High Temperature Membrane Electrode Assemblies

Advent Technologies is the foremost company in the development of high temperature membrane electrode assemblies (MEAs) for use in high temperature PEM (HT-PEM) fuel cells. Founded in 2005, Advent is dedicated to the development and production of innovative materials that support our customer's commercialization of applications derived from these advanced materials. Our products are in commercial systems today and are sold worldwide.



Application

- ▶ Micro Combined Heat and Power (μ CHP)
- ▶ Backup power
- ▶ Stationary uninterrupted power supply
- ▶ Auxiliary power unit (APU)
- ▶ Battery range extender
- ▶ Electrochemical Hydrogen Separation (EHS)

Characteristics

- ▶ Based on advanced polymers and phosphoric acid
- ▶ Two families of products with typical operating temperatures 160°C or 180°C
- ▶ High carbon monoxide tolerance
- ▶ High sulfur tolerance
- ▶ Robust operation across wide variety of contaminants

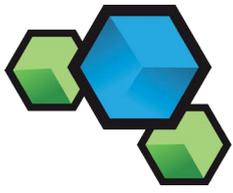
HT-PEM Technology enables simple and cost effective fuel cell systems. When compared to low temperature PEM fuel cells, sub-systems for membrane humidification and carbon monoxide clean up can be eliminated. In addition to simplifying fuel cell systems, when used in electrolysis mode, dilute, contaminated hydrogen can be concentrated and purified.

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Products

Advent's original high temperature membrane is based on pyridine type structures incorporated around a stable polymer backbone. MEAs with this polymer are called Advent TPS® MEAs and are known to operate at the highest temperatures.

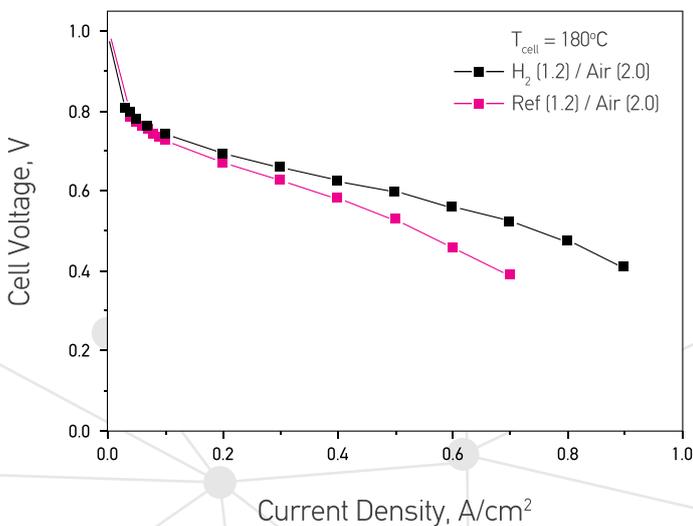
Advent also fabricates a polybenzimidazole (PBI) based MEA under a license from BASF, formerly known as the P1100W. Advent's PBI MEA uses the same materials and assembly processes as developed by BASF and are known for having the

highest phosphoric acid content of any of the high temperature membranes. A new product is the hybrid of Advent TPS membrane with the BASF electrode, which combines the mechanical strength of the TPS membrane and the maturity of BASF electrode technology.

All materials use phosphoric acid as the electrolyte which does not need water for conductivity, and are based on polymers with excellent thermal and oxidative stability.

New Advent TPS® MEAs	Advent's PBI MEA
→ Operates 120°C to 200°C	→ Operates 120°C to 180°C
→ Good acid management	→ Highest acid content
→ Proton conductivity (8×10^{-2} S/cm)	→ Proton conductivity (10×10^{-2} S/cm)
→ Rugged under differential pressure	→ Proven lifetime 20,000 hours
→ Next generation materials >200°C	→ Based on BASF's materials and processes

New Advent TPS MEA (Type ABM)



Advent PBI MEA (Type APM, formerly P1100W)

