



Advent

High Temperature

Membrane Electrode Assemblies

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About

Advent Technologies is involved in the production of innovative materials and systems for their application in renewable energy sources and has commercial activity related to fuel cells and photovoltaic systems. The major effort focuses on **High Temperature PEM Fuel Cell systems** and the development of polymeric materials and catalysts based on its proprietary technology.

Fuel cells offer efficiency, negligible emissions and simplicity. These characteristics, together with large market potential in the power generation sector, place fuel cells among the most compelling of the distributed generation technologies.

Advent Technologies is committed to bring the technology to the mass market, an enabling technology which will dominate the world fuel cells market.

Technology

The operation of polymer electrolyte (PEM) fuel cells at temperatures above 150°C offers very significant advantages. Among others, the tolerance of the catalyst is increased allowing the use of reformed hydrogen with high CO content, the kinetics of both electrodes is enhanced and the thermal management is easier comparing to the conventional PEM fuel cells.

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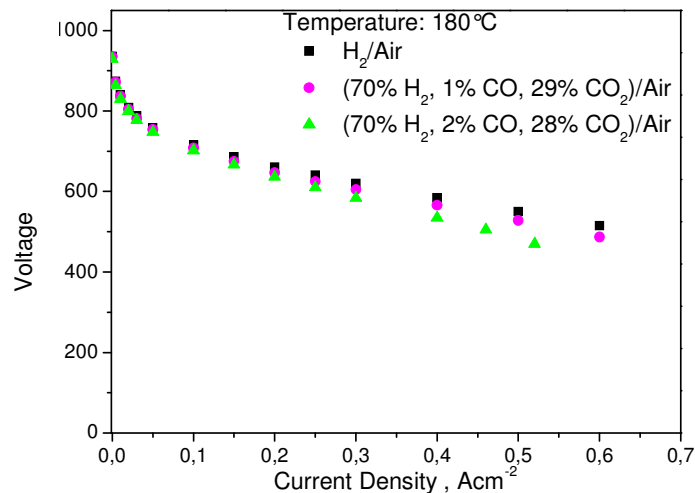
High Temperature Advent TPS® MEAs

Advent Technologies high temperature (150-200°C) MEA is based on pyridine type proprietary ADVENT TPS® polymer electrolytes. ADVENT TPS® technology is polybenzimidazole (PBI) free and less expensive than the competition, allows the use of fuels with high CO content and reduces the complexity and the cost of the final PEM fuel cell system.

Advent TPS® MEA characteristics

- Operational temperature 150-200°C
- Pyridine based aromatic polyether electrolyte
- High Carbon monoxide tolerance
- Long term stability with small voltage drop
- Zero degradation under cycling operating conditions
- Endurance under differential pressure
- No need for humidified gases
- Easier to mass produce due to favourable membrane properties
- Low cost

Advent TPS® MEA performance at 180°C with reformate gas: High CO tolerance



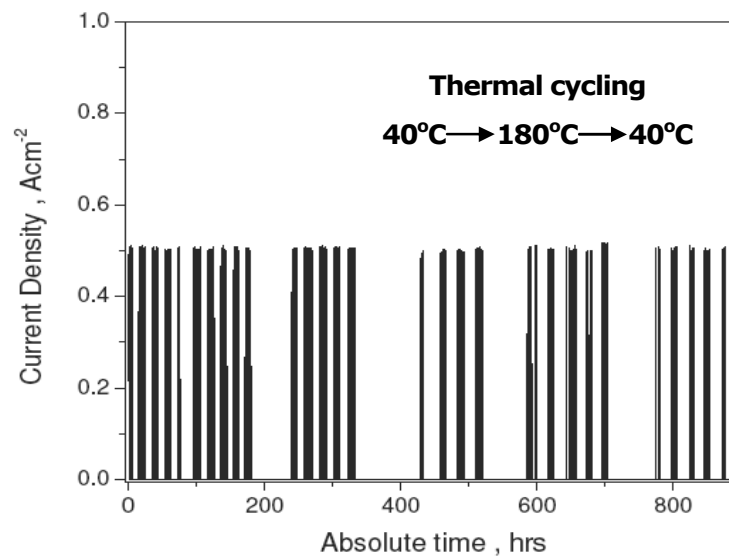
Ambient pressure
Feed: H₂/air
Anode: 1.2
Cathode: 2.0

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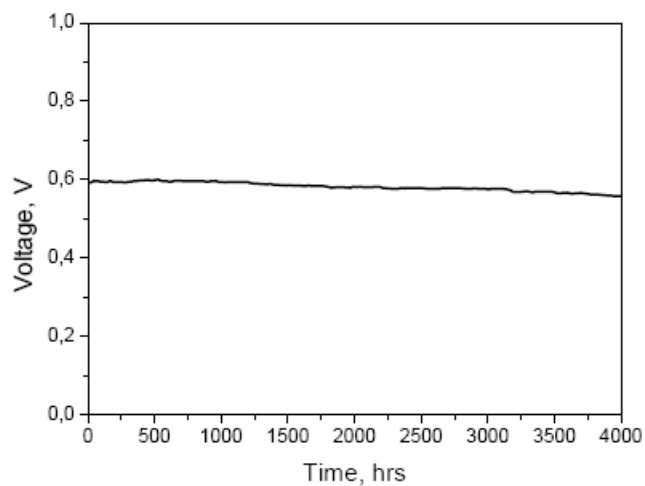
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**Thermal cycling:
Reproducible
performance with
no acid leaching**



Applied Voltage: 0.5V
Ambient pressure
Feed: H₂/Air
Anode: 1.2
Cathode: 2.0

**Operational stability – More than 4000 hrs of continuous operation verified so far
Degradation rate: 9μV/hr**



Current density: 0.2 A/cm²
Ambient pressure
Feed: H₂/Air
Anode: 1.2
Cathode: 2.0

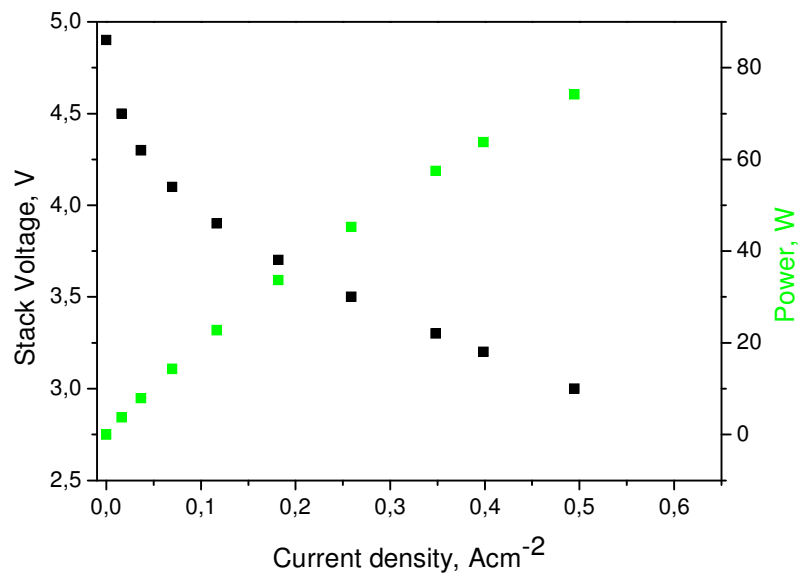
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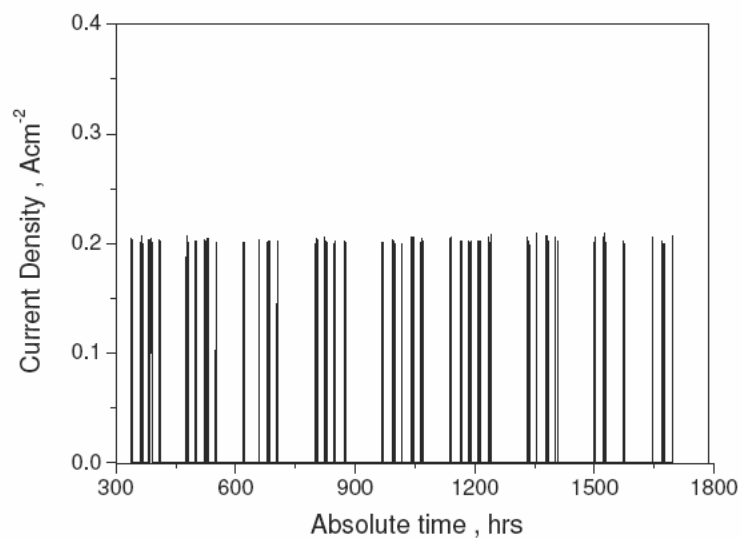
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Stack Data

- Excellent start up/shut-down performance
- 180°C standard operating temperature
- Low phosphoric acid doping level
- High performance



Stack thermal cycling over 100 cycles with zero degradation



Temperature: 180°C
 Ambient pressure
 Feed: H₂/Air
 Anode: 1.2
 Cathode: 2.0
 6-cell stack
 Active area: 50 cm²