Product information

Business Case – Fuel Cell

Together with partner ZBT, Ensinger has developed highly conductive materials, which are used for bipolar plates in fuel cells.
The very special electrically and thermally optimised formulations show their advantage primarily in stationary PEM (polymer electrolyte membrane) applications.

Ensinger focused on the development of materials for PEM fuel cells. A test series was conducted with ZBT. The aim of the test series was to prove the reliability of the material and to demonstrate the performance of the stack.

Material reliability

Tests were conducted under the following framework conditions:

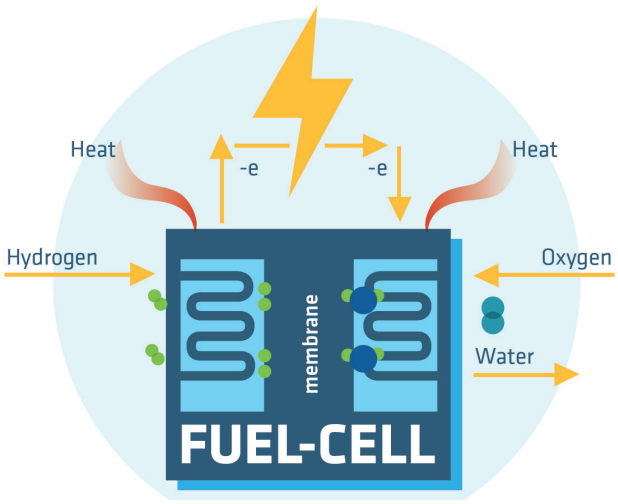
→ Duration: 1,000 h
→ Temperature: 80°C (LT-PEM), 140°C (HT-PEM)
→ Medium: 1-molar H_2SO_4 (LT-PEM) / H_3PO_4 (HT-PEM)
→ Rinsing: Air

Result

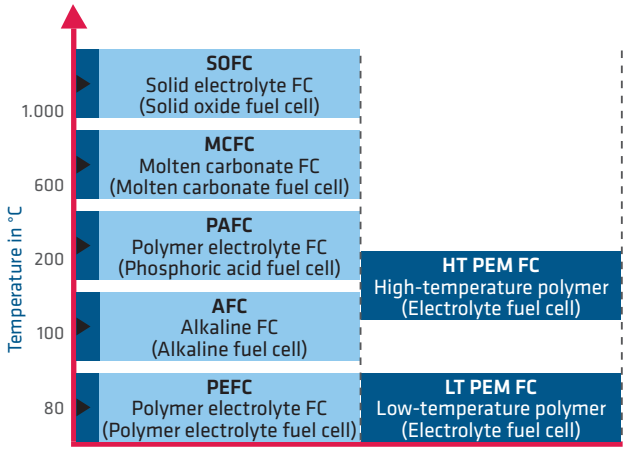
After the tests, the surface of the plates appeared unchanged, and there was no leaching as a result of chemical reactions.

→ The materials are excellently suited to the general usage conditions (LT or HT-PEM).

Diagram of a fuel cell



Types



LT = Low-temperature, **HT** = High-temperature, **FC** = Fuel cell

Stack test

Tests were conducted under the following framework conditions:

→ Test duration: 2,000 h

→ Short stacks: 5-cell, liquid cooling

Description

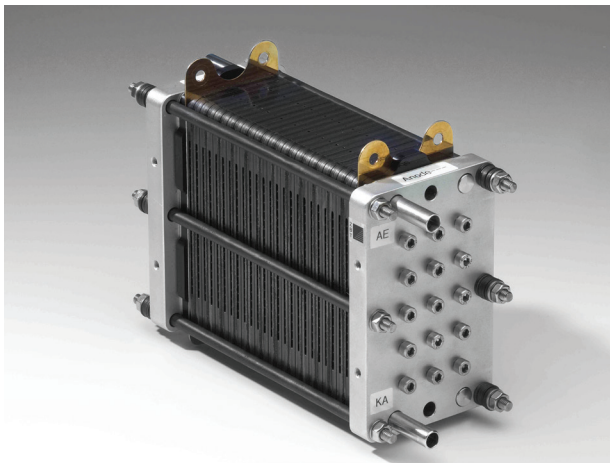
A 24-hour cyclic operation was implemented with various load and thermal cycles as well as resting and cooling phases. The test setup also specifically simulated the start/stop load as well as the fuel cell regeneration.

Result

→ Over an operating period of more than 2,000 hours, the materials in the fuel cell proved to be well suited.

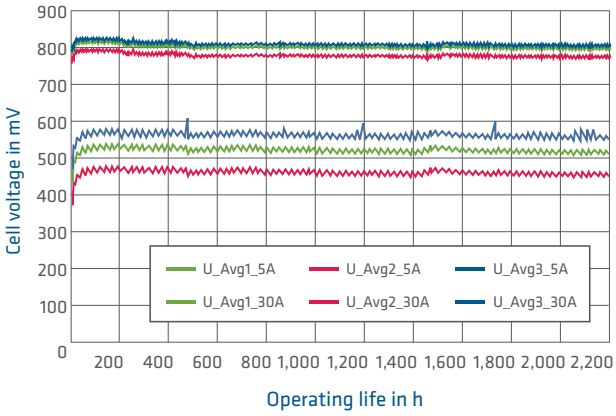
→ Degradation rates of only -5.6 µV/h at 5 A and -4.2 µV/h at 30 A were identified (aim: < 10 µV/h).

→ Further optimisation of the electrical parameters was achieved by optimising the material composition. „Material 3“ appears to score best on all operating points (material 3 basis for TECACOMP HTE products).



Stack sample

Operating performance at 5 and 30A



Overview of materials

Materials are available on the basis of thermoplastics PP and PPS. These are specifically optimised for the production of bipolar plates in the hot press and injection moulding process. In particular, the compounds based on PP are suitable for use in the LT-PEM fuel cell, and the compounds based on PPS for use in the HT-PEM fuel cell.

Electrical properties of the series products

	DIN EN ISO 3915		
	Spec. electrical conductivity	Volume resistivity	
	[S/m]	[Ω/m]	
TECACOMP PP HTE black 4098	$2.5 \cdot 10^{3}$	$3.9 \cdot 10^{-4}$	IM*
TECACOMP PP HTE black 4099	$1.7 \cdot 10^{4}$	$5.95 \cdot 10^{-5}$	HCM**
TECACOMP PPS HTE black 4101	$1.4 \cdot 10^{4}$	$7.0 \cdot 10^{-5}$	HCM**
TECACOMP PPS HTE black 4100	(in development)		IM*

*Injection Moulding, **Hot Compression Moulding

Summary

Both in consideration of the acid resistance in a specific application and in the evaluation of the stack structure, there were no significant changes or voltage losses in operation. The compounds from the TECACOMP HTE series demonstrate excellent suitability for a broad range of applications in the fuel cell under extreme conditions.

Contact

Ensinger GmbH
Compounds
Rudolf-Diesel-Straße 8
71154 Nufringen
Phone +49 7032 819 0
compounds@ensingerplastics.com
ensingerplastics.com