www.amt-gmbh.com www.enitech.de www.ifok.uni-rostock.de www.inp-greifswald.de www.seus-rostock.de

Liquid Reactant Fuel Cell System for Underwater Use*

A first prototype of a pressure resistant fuel cell with liquid fuel and liquid oxidant (LRFC) for underwater use was developed in a common development project. This development is co-sponsored by the German Ministry for Economics, BMWA (AiF, PRO INNO) and will be realized by the private-owned companies AMT GmbH (MEAs, stack), Enitech GmbH (electronics, housing), Seus GmbH & Co. KG (flow systems) and by the institutes IfOK Rostock (catalyst production) and INP Greifswald (pre-treatment of catalysts).

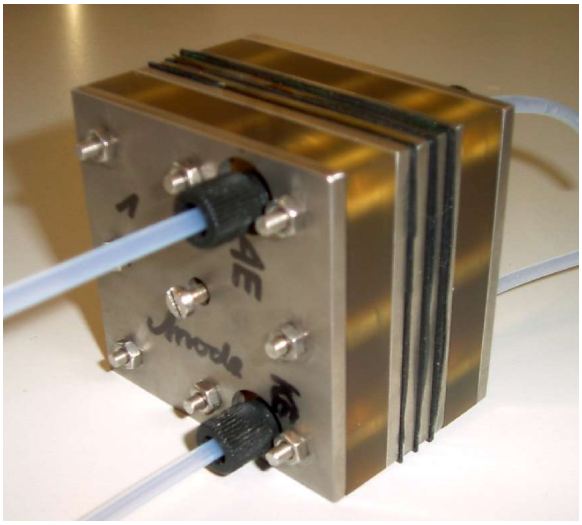


Fig.1: 3-cell fuel stack without housing

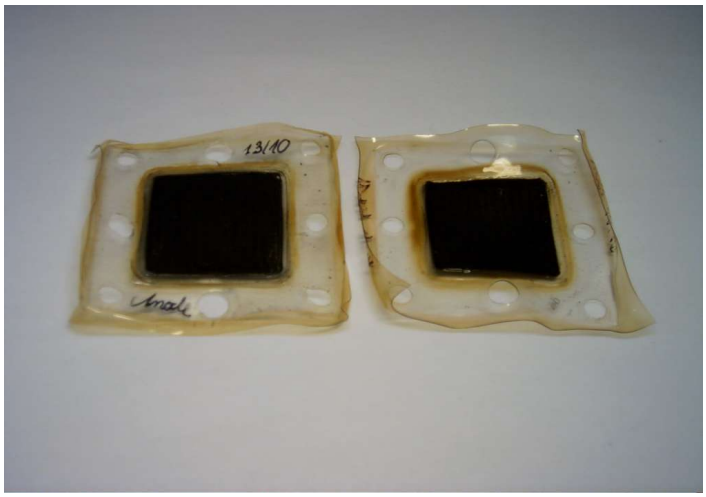
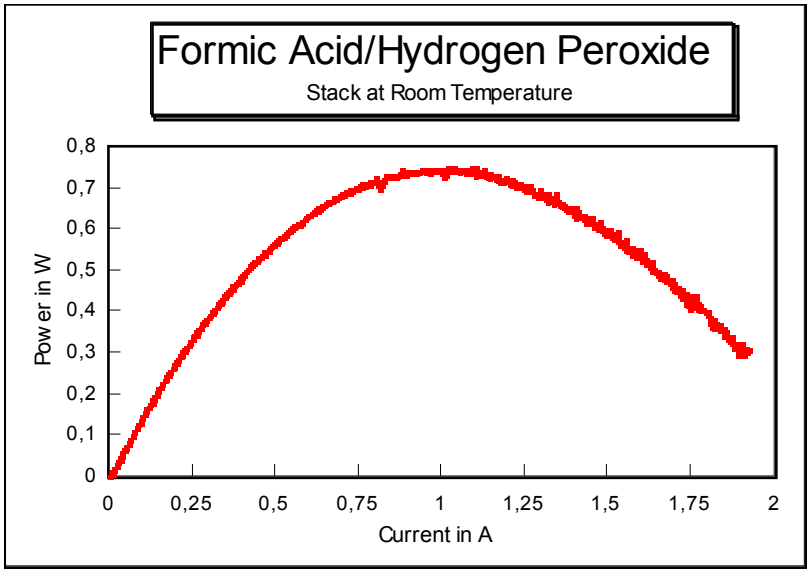


Fig.2: Used Membrane-Electrode-Assemblies (MEA)

The general aim was to develope an innovative, long-time stable and pressure resistant fuel cell system as energy source for different purposes under water at low temperatures (probe systems, AUVs, ROVs, unmanned vehicles). The fuel cell prototype for testing all the special conditions and the performance contains a stack with 3 small cells, flexible tanks, low energy consuming pumps and operates with the liquid fuel formic acid and with hydrogen peroxide as oxidant. New materials have been developed for the stack materials and for the catalysts of both MEA sides.

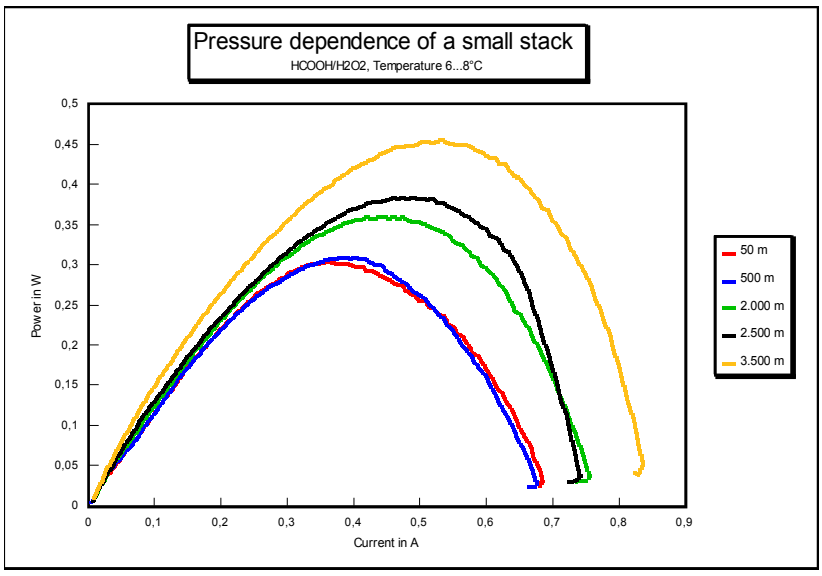
Main advantages of the Liquid Reactant Fuel Cell (LRFC):

- more reliable and safer system compared with H_2/O_2 PEM fuel cells
- innovative catalysts for MEAs with less noble-metal content
- no pressure compensation necessary in deep sea, pressure-neutral design
- expensive equipment for pressure tanks (oxygen, hydrogen) not necessary
- lower weight and technically more simple than H_2/O_2 PEM fuel cells



On the left side the stack performance at room temperature for normal pressure is visible. The maximum current flow for this prototype stack was close to 2 Ampere.

Fig.3: I/W-Diagram at room temperature and normal pressure.



Compared with room temperature the power and current flow near the power maximum is lower at temperatures between 6-8°C.
But it is worth mentioning, that the performance increases with increasing pressure.

Fig.4: I/W-Diagram at low temperatures and high pressures.

Temporary technical data of the prototype:

- Fuel: formic acid, oxidant: hydrogen peroxide
- Catalysts: pre-treated organo-metallic/carbon and noble metal/carbon mixtures
- Pressure range: 0...3.500 dbar
- All parts pressure-neutral covered with flexible materials
- Temperature range: 2...70°C
- Power: up to 75 mW/cm^2 with low loadings
- Total power range on customers demand
- Dimensions of the system flexible

*Claimed Patents:

DE 103 24 200 A1, DE 103 24 201 A1, DE Az: 10 2004 060 081.3-41, DE Az: 10 2004 058 889.9

For more information please contact:

AMT Analysenmesstechnik GmbH
Joachim-Jungius-Strasse 9, D-18059 Rostock, Germany
Tel.: +49 (0) 381/40 59 380, Fax: +49 (0) 381/40 59 383
E-mail: info@amt-gmbh.com www.amt-gmbh.com

Financial support by BMWA (PRO INNO), KF 0455002KFK3

A common development of the partners:
AMT GmbH – Enitech GmbH – IfOK – INP – Seus GmbH & Co. KG