



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

Web: www.amt-gmbh.com

LRFC - Liquid Reactant Fuel Cell System for Deep Sea Use

A pressure resistant fuel cell stack for depths of up to 6,000 m with liquid fuel and liquid oxidant (LRFC) was developed in a common development project. This fuel cell stack is based on the system Borohydride/Hydrogen Peroxide. It was developed by the company AMT Analysenmesstechnik GmbH (MEAs, stack), the Leibniz Institute for Catalysis e.V. (LIKAT) and the Leibniz Institute for Plasma Science and Technology e.V. (INP).

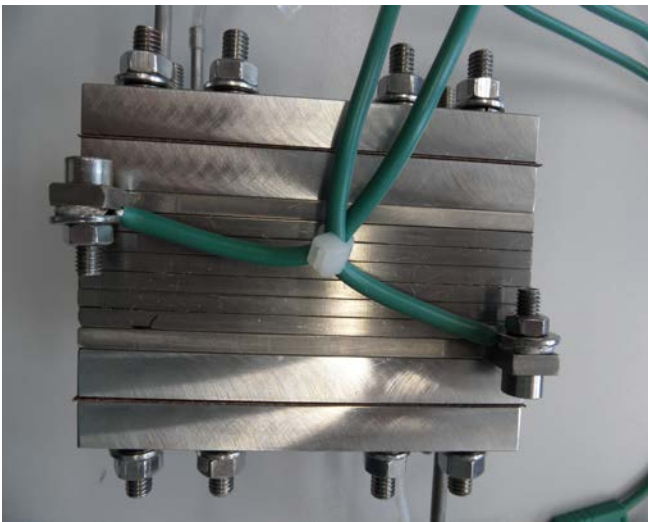


Fig. 1a) 3-cell fuel cell stack without housing.

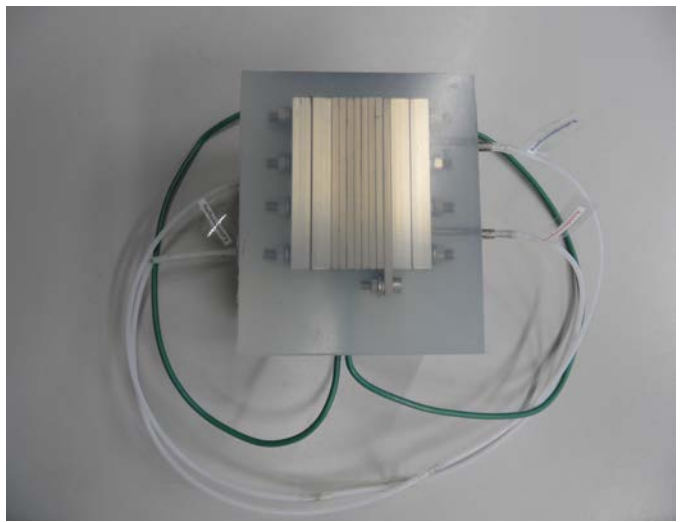


Fig. 1b) Water and pressure-resistant fuel cell stack.

The general aim was to develop an innovative, long-time stable and pressure resistant fuel cell stack as energy source for different purposes under water at low temperatures. The first LRFC fuel cell stack is equipped with 3 cells and operates with the liquid fuel borohydride and with hydrogen peroxide as oxidant. Up to 820 mW/cm^2 net power can be achieved depending on the selected concentrations for the fuel and oxidant.

Main advantages of the LRFC-Liquid Reactant Fuel Cell:

- ☞ more reliable and safer system compared with H_2/O_2 PEM fuel cells
- ☞ new MEA- and GDL-design for more performance
- ☞ no pressure compensation necessary in deep sea, pressure-resistant design
- ☞ lower weight and technically more simple compared with H_2/O_2 PEM fuel cells



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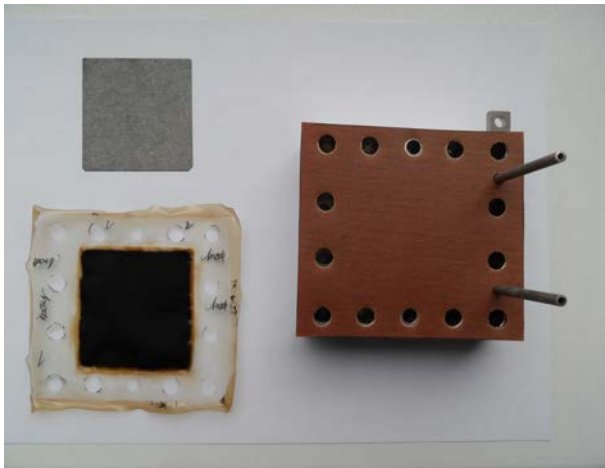


Fig. 2a): Inner parts of the fuel cell.



Fig. 2b) Flow field of the fuel cell

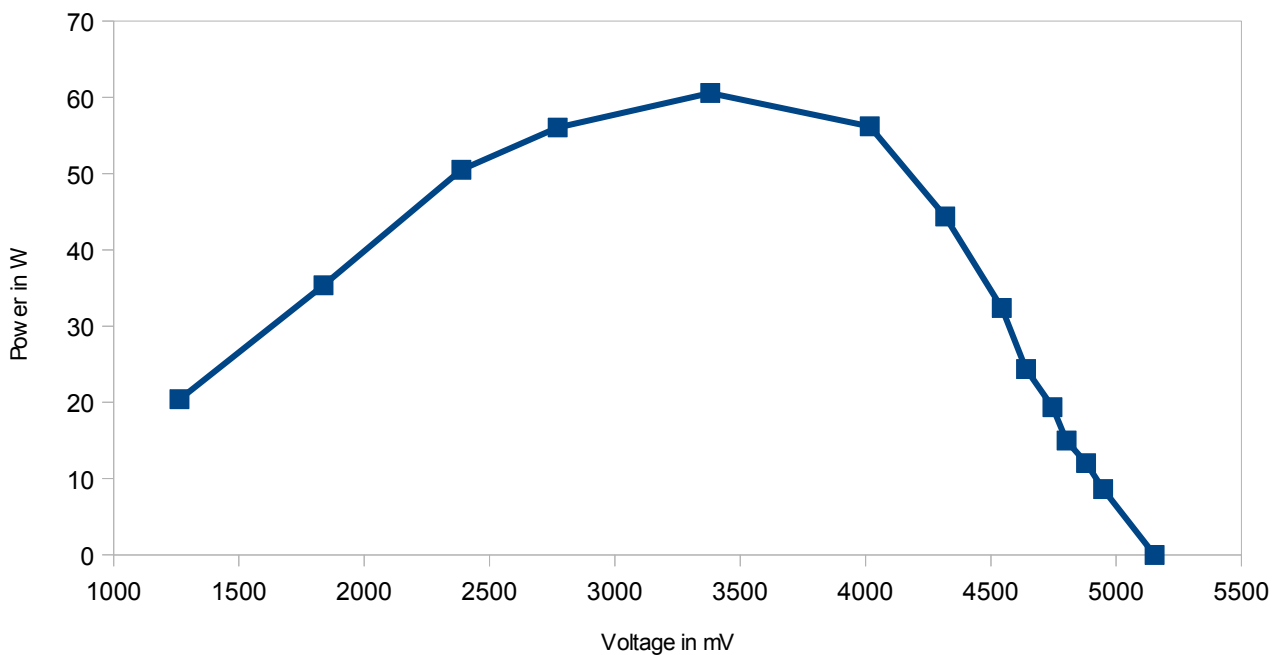


Fig. 3: Power/voltage diagram of a 3 cell stack with 95,76 cm² electrode surface.

Temporary technical data of the prototype:

- ☞ Fuel: alkaline borohydride, oxidant: acid hydrogen peroxide
- ☞ Catalysts: pre-treated noble metal/carbon mixtures
- ☞ Pressure range: 0...6,000 dbar
- ☞ All parts watertight, corrosion- and pressure-resistant
- ☞ Temperature range: 1...70°C
- ☞ Power: up to 820 mW/cm², free selection of electrode surface and cell numbers
- ☞ Total power range on customers demand
- ☞ Flexible dimensions of the system



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Your distributor:

AMT Analysenmesstechnik GmbH

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18059 Rostock, Germany

Tel.: +49 (0) 381 40 59 380, Fax: +49 (0) 381 40 59 383
info@amt-gmbh.com, www.amt-gmbh.com