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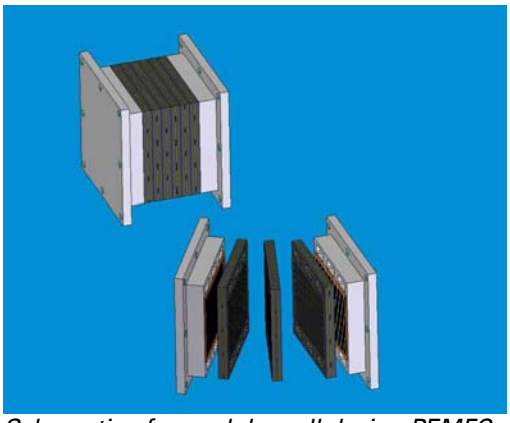
PROJECT PROFILE NO PP191

The Seven-Layer Membrane Electrode Assembly (MEA) –An Innovative Approach to PEM Fuel Cell Design



Schematic of a modular cell design PEMFC stack

OBJECTIVES

1. To develop and characterise an integrated cell module, the "7-layer MEA product", comprising MEA, seals and bipolar plates, that offers:
    a. Increased power density.
    b. Rapid stack assembly designed-in.
    c. Cooling designed-in.
    d. A sealed unit supplied ready to use.

2. To demonstrate cost reduction for manufacturing short stacks at a 'volume production' cost of <£300/kW and a 'mass production' cost of <£60/kW.

3. To demonstrate operation of the modular cell design for at least 1000 hours in single cell and short stack configurations.

4. To demonstrate performance gains (in terms of cell power density and balance of plant) that are possible by using an optimised MEA design coupled to a Biomimetic™ flow field, (performance is judged against that of an 'industry standard' serpentine flow field and Toray GDL).

5. To demonstrate cost reduction by component integration using advanced manufacturing techniques.

SUMMARY

The Proton Exchange Membrane Fuel Cell (PEMFC) is a highly efficient, low emission, power generation device with potential for use in a wide range of applications. The key to its commercial success is the need to significantly reduce cost and improve performance.

Current industry practice is for stack developers to acquire the critical individual cell components from several external suppliers and to assemble these together into the

stack. The stack manufacturer may define specific requirements for these individual components. However, the complexity of the interactions between stack components means that this process is unlikely to yield optimal performance or materials cost. It imposes design constraints on the bipolar plate and MEA manufacturers, which compromises their ability to produce the optimum product on the basis of cost and performance criteria.

This project brings together, for the first time in PEMFC development, a world leading developer of bipolar plate materials (Morgan Crucible PLC) and a world leading MEA developer and manufacturer (Johnson Matthey Fuel Cells) in a unique collaborative programme. Morgan and JMFC will follow a radically different approach to PEMFC design – the 7-layer MEA module.

Morgan will develop new lower cost carbon composite based bipolar plate technology and this will be interfaced with low-cost JMFC MEAs. Bipolar plate flow field design and MEA gas diffusion layer structure will be tailored to optimise the interface, minimise mass transport and resistance losses to improve intrinsic cell electrochemical performance. This technology will then be incorporated into new designs for integrated cell modules that are themselves amenable to low-cost volume manufacturing processes.

The principal beneficiaries of the project will be the smaller system developers who often do not have the resources to optimise the stack configuration and also the principal stack developers who have themselves expressed a preference for outsourcing a unit cell component. In the project many of the issues surrounding performance, intrinsic materials costs and manufacturability of stack components will be addressed in detail. The partnership between Morgan and Johnson Matthey is critical and will enable the UK to gain a world leading position in the production and exploitation of PEMFC cell and stack technology world-wide.

CONTRACTOR

Morgan Group Technology Limited
Bewdley Road
Stourport on Severn
Worcestershire
DY13 8QR
Tel: +44 (0) 1299 872045
Fax: +44 (0) 1299 872093

COLLABORATORS

Johnson Matthey Fuel Cells Limited
Blount's Court
Sonning Common
Reading
RG4 9NH (UK)

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COST

The total cost of this project is £1,325,007 with the Department of Trade and Industry (DTI) contributing £662,503 and MGT and JMFC the balance.

DURATION

24 months – March 2003 to April 2005.

Further renewable energy information from the Sustainable Energy Programmes, and copies of publications, can be obtained from:

Renewable Energy Helpline
Tel: +44 (0)870 190 6349
E-mail: NRE-enquiries@aeat.co.uk

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