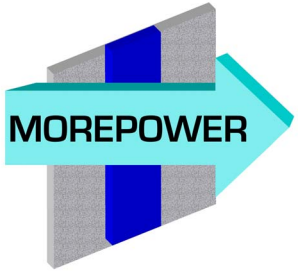

Direct (m)ethanol fuel cell for portable application

Material and system development for DMFC and DEFC, modelling, integration in prototype

SES6-CT-2003-502652
Duration 01.02.04-31.01.07

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Coordinator

GKSS FORSCHUNGSZENTRUM

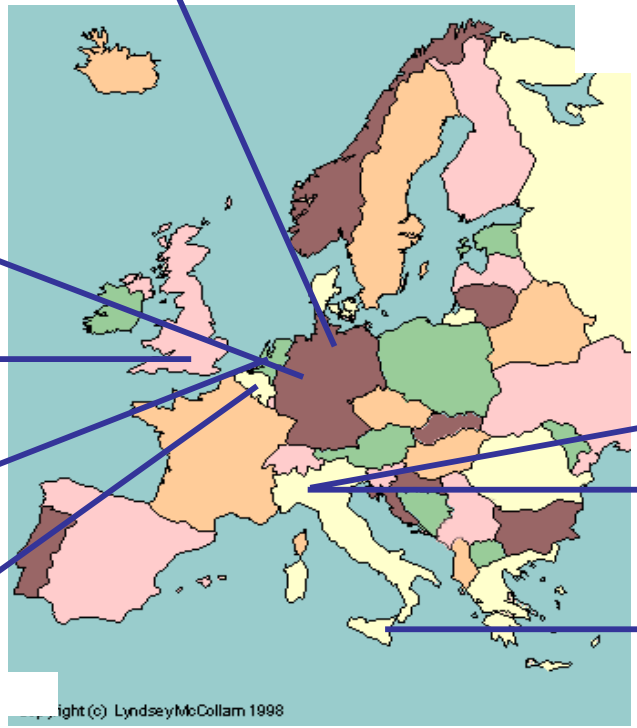
MOREPOWER

IWM

JM Johnson Matthey

Nedstack

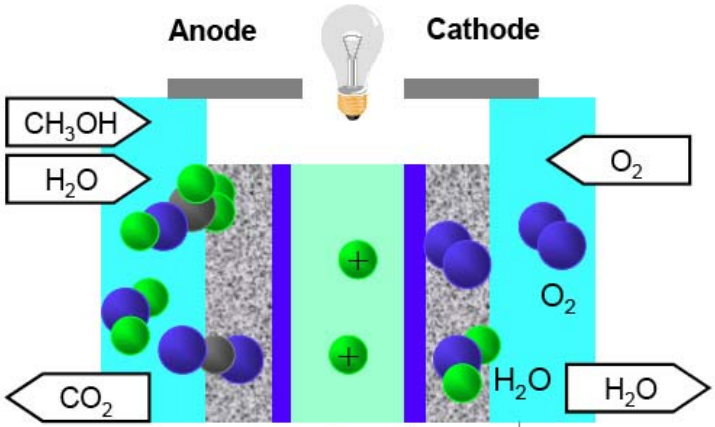
SOLVAY



FIAT

ATAE

MOREPOWER



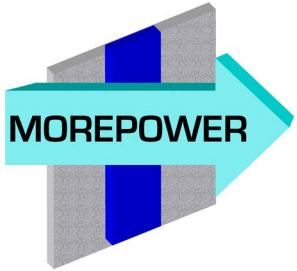
Anode:

$CH_3OH + H_2O \rightarrow CO_2 + 6\ H^+ + 6\ e^-$

Cathode:

$6\ H^+ + 3/2\ O_2 + 6\ e^- \rightarrow 3\ H_2O$

$CH_3OH + 3/2\ O_2 \rightarrow CO_2 + 2\ H_2O$



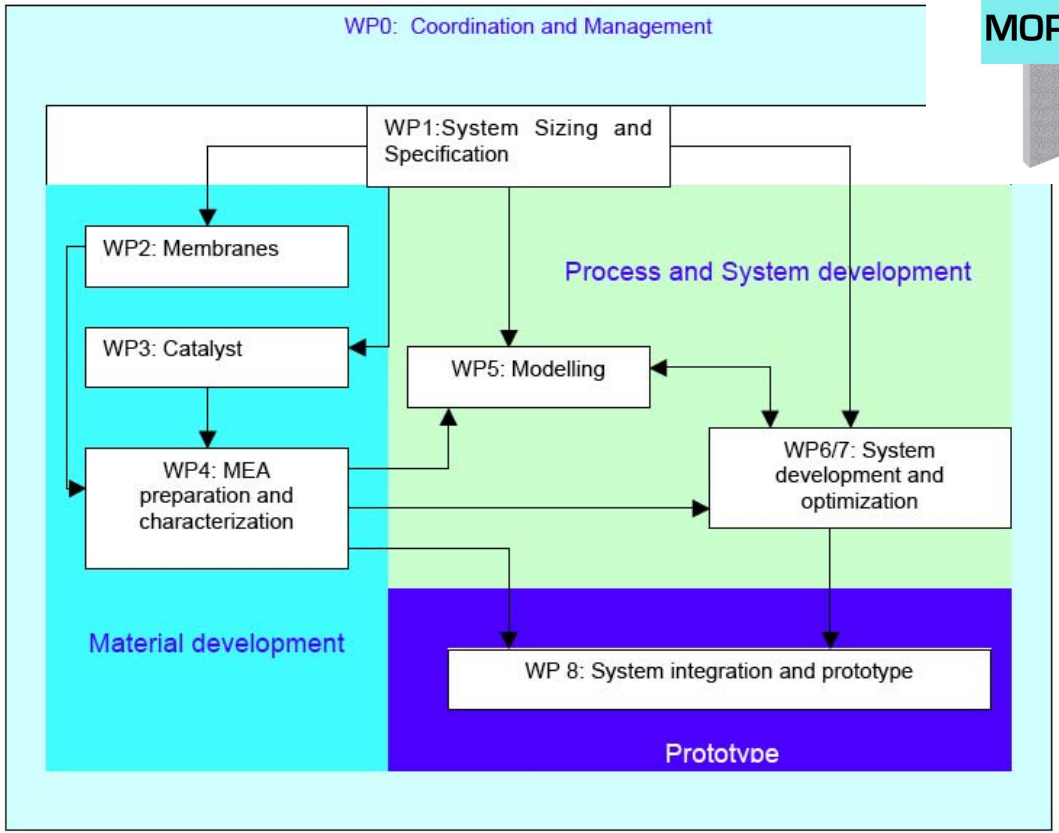
Challenges in MOREPOWER

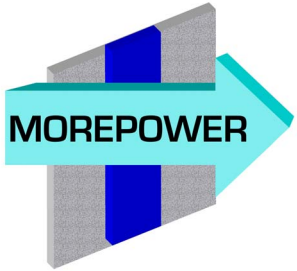
Material development:

- new low-cost proton exchange membranes with reduced permeation;
- new electrocatalyst materials with enhanced low temperature (m)ethanol electro-oxidation activity of the anode;
- cathode catalyst with enhanced oxygen reduction activity lower methanol sensitivity;
- optimised structure of the electrocatalyst and electrode for efficient operation at low temperatures;

System development

- optimised, simplified and miniaturised design of the DMFC device;
- functional components integration


WP0: Coordination and Management
WP1:System Sizing and Specification
WP2: Membranes
WP3: Catalyst
WP4: MEA preparation and characterization
Process and System development
WP5: Modelling
WP6/7: System development and optimization
Material development
WP 8: System integration and prototype
Prototype



Main target:

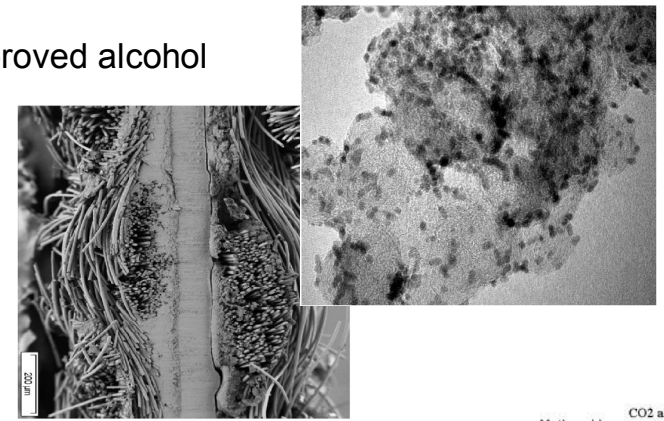
development of a low cost, low temperature portable direct methanol (or ethanol) fuel cell (DMFC) device of compact construction and modular design with aimed power 500 W, operating at 40 A and 12.5 V, temperature up to 60^{o}C and energy density higher than 800 Wh/kg.

Potential use:

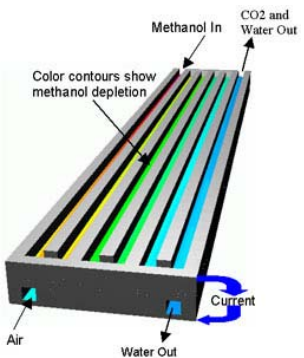
off-grid applications, medical units, weather stations, defence, back-up generators, etc

Project approach

Development of new membranes with inorganic modification, cross-linking and grafting.
Development of better catalysts with improved alcohol tolerance



Modelling and optimization of operation conditions
Miniaturization of peripheric components (pumps, blowers, etc)
Design and components Integration



Standardization

Cooperation with network FCTESTNET (WP3)
Need for common terminology
Need for a testing model and testing program
Need for harmonised format for the (reference) test modules
Better definition of life time estimation

Codes for methanol transport and storage: UFC 1997 article 79, IFC 2000 chapter 34, NFPA 30, CFR 49/TDG regulations

By Application			
1.0	Stationary Fuel Cell Applications		
2.0	Transportation Fuel Cell Applications		
3.0	Portable / Micro Fuel Cell Applications		
	3.1	Hardware / System Design	
		CSA America FC3 Portable Fuel Cell Power Systems	CSA (US) Standard draft in final review
		CSA International Requirement No. 3.01 Portable Fuel Cell Appliances-Safety and Performance	CSA Requirements published
		UL Subject 2265/CSA America FC 11 Hand Held or Hand Transportable Fuel Cell Power Units with Fuel Containers	Joint Activity in progress
		IEC TC 105 Working Group #7 Portable Fuel Cell Appliances-Safety and Performance	International Standard draft in progress
		IEC TC 105 Working Group #8 Micro Fuel Cell Power Systems-Safety	International Standard draft in progress
		Canadian Standards Association Canada Portable Fuel Cell Standard	Canadian Standard draft in progress

Testing and modules: IEC TC 105 working group 9 and 2
(IEC International electrotechnical commission)
www.fuelcellstandards.com

Recently announced portable DMFC prototypes

SFC A50
50W
10.5-14.5 V
6 kg
380 x 260 x 150 mm

NEC
14 W 12 V 900 g + (300 g)
270 x 270 x 40 mm
10 % methanol
carbon nanotube electrode

Fujitsu
15 W 30 % methanol,
non fluorinated membrane,
Pt based nanoparticle catalyst with blocking properties

NTT DoCoMo
5.4 V, 700 mA
180 cc
152 x 57 x 16 mm
30 % methanol

Toshiba
1 W
100 x 60 x 30 mm
130 g, 140 cc

MIT Mobion DMFC
50-100 % methanol
No pumps for water circulation

Nokia
100% methanol
38 g