Materials UK – Energy Materials Town Meeting

Friday 24th November 2006, DTI Conference Centre

Notes of Break-out Discussions on Biomass, Fuel Cells and Hydrogen
(no particular order or priorities agreed)

Attendees: John Oakey Cranfield University
John Kilner Imperial College
George Morris Qinetiq
Peter Edwards Oxford University
Pat Stoneham University of East London
Tak Ishikawa Ilika Technologies
Gary Wright Rolls Royce
Alan Chapman Ceramic Fuel Cells Ltd
Geraldine Verschoor Verschoor Consulting
Xiao Guo Queen Mary, University of London
Suzanne Ellis Johnson Matthey
Joseph McCarney Johnson Matthey
Neil Bateman EPSRC

Biomass

Drivers: Environment – CO2 (cycle must be closed)
Security of supply/diversity (domestic) – in terms of energy sources
Synergy with fossil technologies
New direction for the farming sector – financial benefits
Increases biodiversity
Synergy with waste management
Low tech. – suitable for emerging economies
Local ‘systems’ benefits

Technology Challenges/R&D Priorities:
Diversity of types/variability – need controlled supplies
Food v. energy – land availability
Energy balance/sustainability
Science base – technology, materials
Process improvements
Impurities/corrosion – including tolerance of catalysts, gas separation
Materials costs – plant cost, coatings, catalysts, supply chain
Multi-disciplinary engineering
Opportunity to use waste biomass

Barriers: Gaps in fuel supply chain
Competition from other options
Difficulties with network connection
RAMO – cost and risk issues re. end user and finance availability
Current legislation and structure of incentives
Lack of availability of suitable construction materials
Lessons from other sectors
Recommendations:

Support for demonstration projects
Support for materials R&D to increase plant efficiency, reduce plant costs and cost of electricity – spin-off for other sectors
Improved incentives (local and national) and streamlined legislation
Facilitation of grid connection

People taking this forward:

Lead - John Oakey
Supporters - to be determined

**Fuel Cells**

Drivers: (in addition to security of supply and environmental benefits)
Scaleability – CHP to large scale generation
Efficiency – cost benefit and CO2 reduction
Portability – automotive pull should provide infrastructure
Easily delivered complex systems
Back-up/emergency/remote electricity supplies
Steady supply cf. other types of renewable generation

Technology Challenges/R&D Priorities:

<table>
<thead>
<tr>
<th>Low Temperature (PEM)</th>
<th>Both</th>
<th>High Temperature (SOFC)</th>
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<td>New materials</td>
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<td>Cost</td>
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<td>Polymer stability –</td>
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<td>Ceramic processing</td>
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<td>seals/membranes</td>
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<td>Failure mechanisms – lifing</td>
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<td>O2 reduction</td>
<td>Catalysts (systems)</td>
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<td>Poison tolerance – CO, S, ..</td>
<td>New options – scalable, manufacturability</td>
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<td>Avoid precious metals</td>
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<td>Corrosion</td>
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<td>Polymers, precious metals</td>
<td>NiO, Co, …</td>
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<td>Systems, Degradation, mechanical behaviour, validation (accelerated testing), electro-chemical, …</td>
<td>Modelling</td>
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Barriers: Manufacturability – supply consistency, quality, volume
Cost – metals
Market entry
Lack of commitment – government, companies

Recommendations:
Funding – research (UK strength – innovative materials),
deployment/demonstration
Focus on materials supply – globally
Window of opportunity – now!

People taking this forward:

Lead - John Kilner (Imperial College)
Supporters – Gary Wright (Rolls Royce)
- Alan Chapman
- Patricia Stoneham
- Geraldine Verschoor

Hydrogen

Drivers: (in addition to security of supply and environmental benefits)
Energy carrier
Clean at the point of use
Flexible supply options

Technology Challenges/R&D Priorities:
Production with minimal CO2 emissions (coupled with CCS)
Separation membranes
Catalysts for a range of feedstocks
Photo-catalysis
Storage materials/systems
Different scales need different solutions
Technical solutions to perception issues
System efficiency – fuel cells + GTs
Transportation – methanol, ammonia, ..
RAMO

Barriers: Lack of existing infrastructure
Funding
Lack of vision
Perception
Economics

Recommendations:
Co-ordination of H2 and conversion technology initiatives
Funding – demonstrations, bridging technologies

People taking this forward:

Lead - Peter Edwards (Oxford)
Supporters - Xiao Guo (Queen Mary)
- George Morris
- Patricia Stoneham
- Geraldine Verschoor

John Oakey – 3 December 2006