



TSB HFC Showcase Event

Development and Demonstration of a UK Manufacturing Capability for High Temperature Electrodes

June 2011

Martin Green



Johnson Matthey

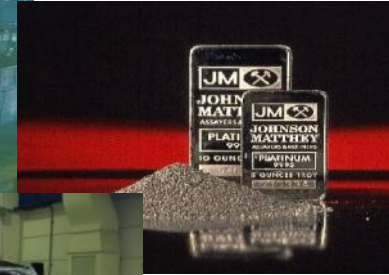
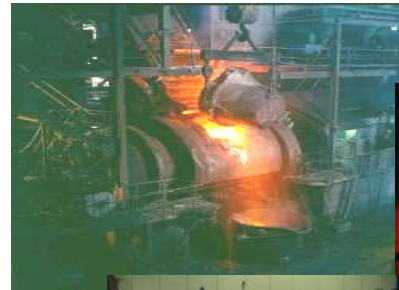
Johnson Matthey

Johnson Matthey (JM)

- Founded 1817 in London
- FTSE-100, £10bn sales, £280m operating profit
- 9,000 employees in 40 countries
- Focused on environmental and advanced materials technologies
- Annual R&D investment ~£110m

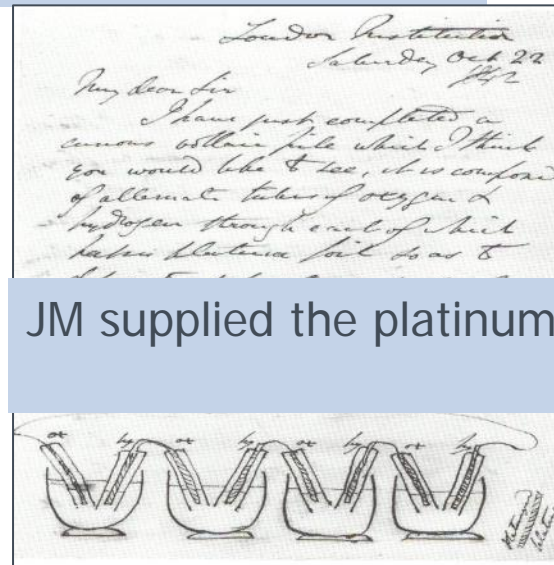
JM, Hydrogen and Fuel cells

- Fuel cell stack components
- Hydrogen processes and catalysts
- Fuel processing catalysts
- Hydrogen storage materials



Johnson Matthey Fuel Cells

- Long association with fuel cells
- Developer of stack components
 - membrane electrode assemblies
 - catalysts and catalysed components
- Broad range of applications
 - transport (hydrogen)
 - portable (methanol)
 - stationary (natural gas)
- Recycling



World's first fuel cell
Sir William Grove
London 1842



World's first dedicated membrane electrode assembly facility, Swindon
2002



Medium temperature fuel cells

- medium temperature fuel cells well-suited to stationary CHP applications:
 - proven performance and durability (hundreds of systems worldwide, millions of hours of operating experience)
 - good electrical efficiency (40%) and heat suitable for space heating/cooling
 - commercially available today (>1000 systems sold 2011)
- requirement for improvements in cost, durability
 - materials thrifiting (platinum)
 - increased performance (new catalysts, substrates)
 - reduced performance decay (new catalysts, materials treatment)



Examples of commercially available medium temperature CHP systems



Electrode Development Programme

- Rolling electrode development programme at JM driven by industry requirements
 - partly via a TSB-assisted, collaborative R&D project (JM and TFP)
 - delivered improvements on some of the key challenges
- Technical Fibre Products Ltd (TFP)
 - subsidiary of James Cropper plc
 - specialist paper production and converting businesses
 - world leading manufacturer of advanced non-woven products to range of industries
 - deep understanding of fibre processing, particulate material incorporation
 - knowledge of heat treatment, processing industries
 - active in fuel cell supply chain for many years
 - 10+ year collaboration with JM on fuel cell component development



For a component developer it's different

learning from demonstrations of 1 or 10 or 100 is limited

- learning comes from 10,000 per week..
- From a *component developer's perspective* fuel cell markets are closely linked
 - component development needs
 - fundamental catalysis
 - mass transport within cell
 - cost reduction
 - manufacturing process development
 - defect rate reductions to automotive levels
 - supply chain development
 - introduce new supply options



Demonstration Project

- Building on a previous TSB collaborative R&D project between JM and TFP
 - Develop new products and processes aimed at components for fuel cells operating at 150-200°C
- *“to design and install a 1/10 commercial scale demonstration plant for manufacture of the catalysed electrodes developed in the earlier project”*
 - new manufacturing technology
 - novel coating process
 - improved process capability
 - new plant designs at JM and TFP
 - in-line process control and automated inspection
 - new sub-components
 - validation of UK supply chain
- total investment of £3.0m between partners



Results

- new manufacturing technology for novel coating process

- improved process capability
 - new plant designs at JM and TFP
 - in-line process control and automated inspection

- new sub-components
 - validation of UK supply chain

- Project was essentially complete by March 2011:
 - ✓ world's first pilot scale plant for new coating technology
 - ✓ first parts manufactured and validated at customer Q4 2010
 - ✓ manufacturing at design capacity demonstrated Q1 2011
 - ✓ significant improvements in defect prevention
 - ✓ successful implementation of automated process control techniques
 - ✓ >10x improvement in defect rate demonstrated at volumescale up of substrate manufacturing capability at TFP complete Q3 2010
 - ✓ enables UK supply chain for new substrate material

✓ With TSB support the Project successfully demonstrated scaled manufacture of new components and novel manufacturing technology





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