CRONET Days - Nantes - 28th/29th April 2005

Real-SOFC

Realising Reliable, Durable, Energy Efficient and Cost Effective SOFC Systems

Project Overview and Future Development Needs

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Forschungszentrum Jülich

Supported by the European Commission under the 6th Framework Programme
Contract nº SES6-CT-2003-502612

Part 1:
Project Strategy & Achievements

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Project Objectives

To improve the durability of **planar** Solid Oxide Fuel Cells, esp. under practical operating conditions.

- Main goal: Understanding and reducing ageing — Enhanced lifetime
- Reduction of degradation to 0.5% / 1,000 hrs.
- Extension of stack lifetime above 10,000 hrs.
- Tolerance for fuel gas impurities — Ease of operation
- Operation with dry methane
- Standard formats and testing routines — Cost & reproduceability
- Life Cycle Analysis & environmental impact analysis — Sustainability

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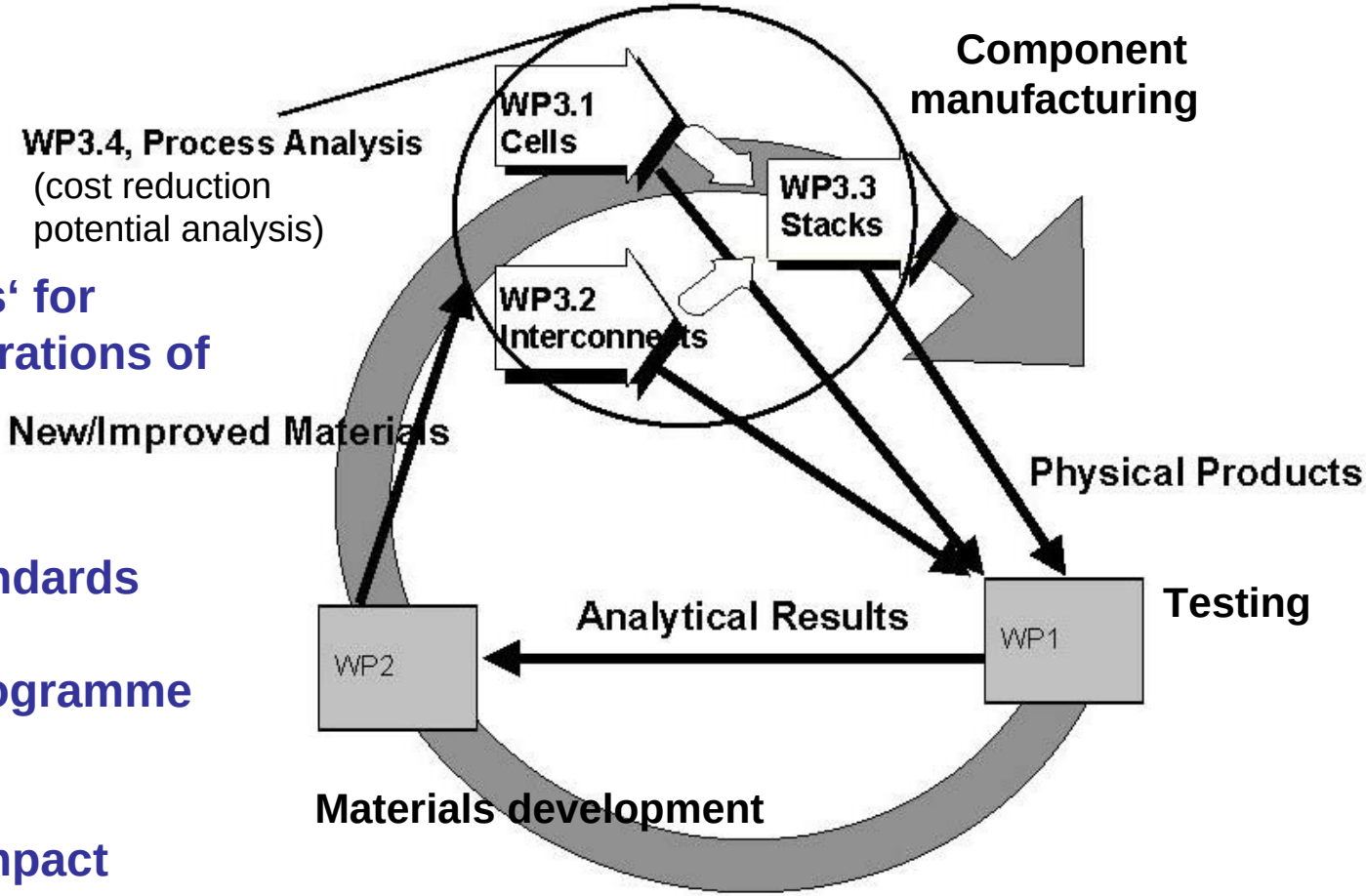
Project Approach

‚Feedback Loops' for 2 improved generations of components

Joint testing standards

Joint training programme

Assessment of environmental impact



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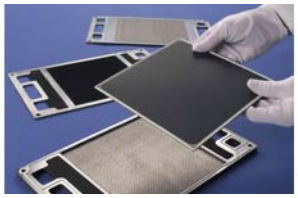


Pushing the Limits

State-of-the-Art (2003)

IDU-SOFC	3% degradation/ 1000 hrs.
CORE-SOFC	850 °C
ProCon	
Cexicel	
IM-SOFC	
PIP-SOFC	
SOFCNet	
FCTestNet	

Project Industry Partners

(stack development outside project, protection of industrial IPR)

(New) Materials & components

Industrial components for testing

Products

Knowledge

Project R&D (2004-2008)

Real-SOFC

0,5% degradation/ 1000 hrs.
500..2.500 Euro/ kW (stack, CH_4)
750 °C
Thermal cycling capability
Gaseous fuels
Joint European research effort

SOFC market prospects

0,1% degradation/ 1000 hrs.
500..2.000 Euro/ kW (system, CH_4)
650 °C
Gaseous & liquid fuels
European Industry and R&D Network

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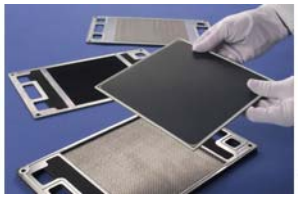


Consortium Members

STACK

CEA, ECN, EMPA, FZJ,
Risø, VTT,
FORTH-ICE/HT,
Imperial College,
Univ. B'ham, Univ. Sofia,
Univ. Genoa,
EdF, GdF, Sulzer,
EBZ

SYSTEMS

CEA, DLR, ECN,
EMPA, FZJ,
Risø, SINTEF,
FORTH-ICE/HT,
Univ. Sofia,
Univ. St.Andrews
HCStarck, Plansee
RRFCS, U&A

COMPONENTS

DLR, ECN, FZJ,
HTAS, Sulzer,
RRFCS,
HTCeramix

Energo,
Wärtsilä

Green = Res.Inst.
Blue = Univ.
Red = Industry
Yellow = SME

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First Year Achievements

- Set-up of project infrastructure
- Joint standards for testing
- Steel interconnect materials with promising results
- Extensive characterisation of cathode materials, 2nd Generation feature
- Promising first results for coking and H_2S tolerant anodes
- Extensive characterisation of protective layer candidate materials combinations for featuring in 2nd Generation stacks
- Summer school & workshops
- Public website (www.real-sofc.com)

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Part 2:
Technology Outlook

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SOFC Potential in Future Energy Supply

- **Fuel flexibility** (H_2, CH_4, syngas, with reformer: C_nH_m, diesel, petrol ...)
- Role in **transition strategies** from fossil feedstock to renewables and to hydrogen (but also encompassing future biomass-derived, carbon-based fuels)
- **Minimal** need for **fuel processing:** advantage for small residential CHP, portable units, APU etc.
- Potential for **fuel impurity tolerance** due to higher temperature

Status:

- High efficiency & high volumetric and area power density
- Degradation rates below 2% / 1,000 hrs., Lifetimes > 3,000 hrs.
- Insufficient cycling and intermittent operation capabilities
- Strong European industrial base

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Problems to Solve & Rewards to be Expected

Problems to solve

- Adaptation of SOFC stacks to application requirements
- Ruggedness
- Low cost materials and manufacturing processes

Rewards

- High electrical efficiency
- Fuel flexibility
- High value off heat

All this is of special relevance to APU.

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Future SOFC Research Topics

- Integration of stacks into systems (mobile & stationary)
- Interface definition for integration of stacks and/or systems into FC or energy supply systems
- Consequences of part-load operation
- Standardised operational requirements of applications
- Adequate profiles of operation (equivalent to NEDC) & resulting requirement profiles
- Balance of plant development
- Testing standards and procedures
- Non-invasive testing methods
- LCA based on practical operational data

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Prospective Real-SOFC Research Partners

Specialisation

- Component developers
- System integrators (mobile & stationary)
- Balance of plant suppliers
- Testing equipment suppliers
- Specialised materials suppliers, processors and developers

Possible ways of integration into the IP

- Transfer of know-how through licenses and commercialised results
- Testing services for component suppliers
- Information exchange on commercially available project results
- Participation in summer schools and public workshops

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