MMLCR=SOFC
Working towards Mass Manufactured, Low Cost and Robust SOFC stacks

Deliverable D 7.4

Project Web Site

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Project abstract

Lightweight SOFC stacks are currently being developed for stationary applications such as residential CHP units, for automotive applications such as APU and for portable devices. They supply electrical efficiencies of up to 60%, a high fuel flexibility, being able to operate on syn-gas from Diesel reforming as well as LPG, methane or hydrogen, and promising costs due to greatly reduced amounts of steel interconnect material.

The project proposal addresses a novel design solution for lightweight SOFC stacks that decouples the thermal stresses within the stack and at the same time allows optimal sealing and contacting. In this way the capability for thermal cycling is enhanced and degradation of contacting reduced. Performance is increased since the force needed for secure contacting is now independent of the force required to secure gas tightness of the sealing joints.

The design is highly suitable for industrial manufacturing and automated assembly. The industrial partners will build up the necessary tools and appliances for low cost production of repeating units and the automated quality control, stacking and assembly of stacks.

In mobile and portable applications the requirements for thermal cycling are high. It is therefore essential that lightweight stacks have excellent thermal cycling and rapid start-up capabilities. The stack design supplies a compensation of thermo-mechanical stresses between cell and cell frame / repeating unit. Thin steel sheets with protective coating are used for the sake of cost reduction and sufficient stack lifetime, also for stationary applications. The latter will also benefit from improved start-up times, since this allows a more flexible and load-oriented operation.

Acknowledgment:

The research leading to these results has received funding from the European Union’s Seventh Framework Programme (FP7/2007-2013) for the Fuel Cells and Hydrogen Joint Technology Initiative under grant agreement no. 278525.
Abstract of Deliverable

This deliverable documents the web site arranged for the project on the pages of the University of Birmingham.
Project Web Site Development

The project web site has been set up on the web system of the university of Birmingham for several reasons:
- long-term independence of any external suppliers of web services, including attached costs
- freedom of unlimited access and support
- embedding in context of university backup and maintenance

The URL www.mmlcr-sofc.eu was booked (at reasonable cost) and used to host a referral to the UBHAM site pages.

The web site contains a public face with general information on the project, including the public deliverables. At later stages of the project this will be used to promote project results. It also hosts a 'private' section with a protected area for internal project information exchange.

The following pages document the basic structure of the web pages.

Due to the programming structure in a Content Management System it is hardly possible to print the pages as they appear on screen. Therefore the following annex pages are a mix of screenshots and actual content and do not fully embrace the visual impact in a web browser.
Lightweight SOFC stacks are currently being developed for stationary applications such as residential CHP units, for automotive applications such as APU and for portable devices. They supply electrical efficiencies of up to 60% with high fuel flexibility being able to operate on syn-gas from Diesel reforming as well as LPG, methane or hydrogen at promising costs due to greatly reduced amounts of steel interconnect material.

Also in 'Mass Manufactured, Low Cost and Robust SOFC stacks'
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The design is highly suitable for industrial manufacturing and automated assembly. The work in this project thus includes the development of mass-manufacturing-tailored manufacturing and assemblage technology and processes that will allow drastic cost reductions whilst securing a high level of reproducibility and in-process quality assurance.
The project logo is inspired by the sine wave spacer and colours reflect cathode electrolyte and anode.

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Project Overview Menu, followed by page content
Project Overview

Aims

1. Further developing and qualifying the JÜLICH lightweight SOFC stack with flexible integration of the SOFC cells in the stack and separate contacting and sealing force with respect to design, sealing materials and protective coatings; evaluation of the environmental impact of the SOFC stack product and environmental optimisation.

2. Establishing industrial mass manufacturing processes and equipment for repeating unit manufacturing, including low-cost produced cells.

3. Establishing automated industrial mass manufacturing processes and equipment for stack assembly and joining.

4. Performing tests under relevant application operating conditions for steady state and transient operation.

5. Verifying the industrialisability and market relevance of the project results with the perspective of adequate valorisation after project termination.

Problems addressed

- New architecture with reduced thermal stresses.
- Improvements of performance and reliability: robustness to cycling and transient operating conditions.
- Simplification of manufacturing
- Improved quality assurance by automated assembly.
- Cost efficient design.
Project goals

- Reduce thermal stress in modified Juelich CS IV design.
- Implement improved glass sealants and sealant processing.
- Optimise application of protective coating prior to and after forming step.
- Design and optimise automated manufacturing process.

Outcome

- Lightweight stack for transport or stationary applications.
- Reduced cost, improved robustness and quality (reproducibility).
- Mass-manufacturing compatible processes and assembly machines.

Future perspectives

- Commercialisation of stack technology through consortium partner SOFCpower.
- Coating solutions through consortium partner Turbocoating.
- Glass sealants via FZJ and CSIC activities.
- Manufacturing solutions through consortium partners BORIT and Rohwedder (both with respect to process control/machines/ process development, and component manufacturing).
Consortium Menu, followed by page content
Consortium

THE UNIVERSITY OF BIRMINGHAM - COORDINATOR

Chemical Engineering at the University of Birmingham (UoB) is a leading research group on fuel cells in the UK. Between 2007 and 2008, AWM (Advantage West Midlands – Local Development Agency) awarded more than £6 million to Birmingham and Warwick Universities to create an R&D facility for hydrogen and fuel cells which could be utilised by SMEs in the West Midlands region within the Science City Initiative nationwide governmental programme. The University of Birmingham in collaboration with Loughborough University and the University of Nottingham are part of the Midlands Energy Consortium (MEC). The consortium has a critical mass of faculty specialising in hydrogen and fuel cell technology, with 30 academic staff - more than any other UK location. Integrated Planar, Planar and micro-tubular (mSOFCs) have been studied at UoB since 2000 and ten PhD students have gained their degrees in that field and gone on to work in the fuel cell industry, at, for example, Rolls Royce (UK), Acumentrics (USA) and Nanodynamics (USA). World class facilities are available for testing materials, cells and stacks.

UoB was recently awarded £5.5 million funding over five years from the UKRC (UK Research Councils - with major stake from Engineering and Physical Sciences Research Council (EPSRC), the UK funding body for science and engineering to establish a centre for doctoral training (CDT) to train 50 doctoral students (with intake of around 10 a year starting from 2009) to meet increasing demand from industry and society for skilled scientists and engineers in the “Hydrogen, Fuel Cells and their applications” research field (www.fuelcells.bham.ac.uk) producing graduates with the skills to take on the global challenges now faced by the field.

In the Centre we have at present three state of the art test rigs for SOFC stack long term testing provided by Advanced Measurement Inc. (Canada). They are fully automated with capabilities of various modes of accelerated age-testing including load, redox and temperature cycling. We are likely to acquire an additional one this
year. These extensive testing facilities would enable us to confidently embark on and to carry out the scope of work planned for this project.

**Co-ordinator:** Prof. Dr. Robert Steinberger-Wilckens, Physics degree in 1986, Ph.D. degree in 1993 from University of Oldenburg, Germany. He founded the engineering consultancy PLANET in Oldenburg in 1985 and has held a leading role there since 1993 performing a variety of projects in energy efficient building technology, water saving, solar and wind energy, biomass, and hydrogen (mobile and stationary applications). He was project manager in Fuel Cells, responsible for the Solid Oxide Fuel Cell development at Forschungszentrum Jülich from Feb. 2002 to Jan. 2012. From Feb. 2012 he has held the position of Chair for Hydrogen and Fuel Cell Research at the University of Birmingham. He is author of over 130 scientific papers in the areas of renewable energies, hydrogen and fuel cells. He was involved in the ‘Stationary Applications’ working group of the Joint Undertaking N.ERGHY and acted as the project co-ordinator for the t Real-SOFC Project.

**Main scientific contact person:** Dr Artur Majewski in Birmingham’s School of Chemical Engineering is engaged in SOFC development and worked on the REAL-SOFC project (FP6) on durability and rapid cycling of SOFCs. He will provide technical direction to optimise the prototype systems defined by the Consortium partners. He is also interested in modelling of SOFC at cell and stack level.

**FORSCHUNGSZENTRUM JÜLICH GMBH**

Forschungszentrum Jülich GmbH (JÜLICH) is one of the leading research institutions in Germany with approx. 4 400 employees. Energy technology is one of the main research topics with an involvement of approx. 350 person-years. Protection of the environment and of natural resources, economy and safety are among the prime research goals.

The SOFC group at JÜLICH is one of the world's largest and has produced a number of world record breaking achievements. Stacks of the planar SOFC design were built up to a size of approx. 15 kW; high performances were achieved with advanced cathode materials; stacks were successfully delivered to other research institutions and operated in SOFC systems under atmospheric and pressurised conditions. Over the past 15 years JÜLICH has been involved in several national programmes on SOFC co-operating with industries like Siemens and BMW as well as in several European projects co-operating with research institutes (ECN, Risø
National Laboratory, VTT, CEA, etc.) and industries (Haldor Topsoe, H.C.Starck, Wärtsilä, Sulzer Hexis, Rolls Royce Fuel Cell Systems etc.). Under the 6th Framework Programme, JÜLICH was the co-ordinator of the Integrated Project Real-SOFC and the STRP GenFC as well as being a partner in various other IP, as for instance SOFC600, and networks such as FCTestNet, SOFCNet and recently FCTestQA. Within the FCH JU framework JÜLICH coordinates the cooperative project SOFC-Life as well as two Support Actions, TrainHy and FC-EuroGrid.

Within this proposal the Institute of Energy and Climate Research (IEK) and the Dept of Central Technology contribute their work.

Besides the SOFC research, JÜLICH also hosts an equally large group working on low temperature fuel cells, predominantly DMFC, on fuel reforming, hydrogen production and system analysis.

Main scientific contact person: Prof. Ludger Blum

BORIT NV

Borit’s mission is to contribute to the Hydrogen Economy by developing a leading and cost-efficient production infrastructure of bipolar plate / interconnect assemblies for fuel cells and electrolyzers and providing excellence in metal forming, cutting, welding, coating and sealing.

Borit is a total solution provider for thin high-precision sheet metal products. As a one-stop enterprise, Borit is dedicated to support customers and partners through the complete product development and manufacturing cycle. Borit’s cornerstone technologies are its proprietary Hydrogate forming technology and its high precision laser welding technology for full automatic assembly of bipolar plates.

Hydrogate, Borit’s unique forming technology enables cost-efficient forming of sheet metal flow plates like interconnects. Currently, Borit has all key processes such as forming, cutting, welding, marking installed for manufacturing from prototypes to series production in house. As one of the key global providers, Borit has an in-depth knowledge and broad experience to satisfy specific and challenging customer requirements.

The main application fields are PEM (LTPEM and HTPEM), DMFC and SOFC fuel cells.
cells as well as electrolyzers (alkaline, PEM and SOEC). Further applications are in the fields of cooling solutions, microreactors and light weight construction.

Borit NV is a spin-off company of OCAS NV and Borit Leichtbau-Technik GmbH, established in 2010, backed by strong shareholders. Borit NV is based in Geel, Belgium.

**Role in the project**
- Together with other partners development of improved design for metallic interconnects
- Preparation of a wide variety of sheet metal samples mainly for coating and sealing tests
- Forming of metal sheet interconnects in different materials with proprietary Hydrogate technology
- Laser cutting of interconnects
- Development and production of new spacer plates for simplified cassette assembly

**Main scientific contact person Dr. Joachim Kroemer**, Dipl.-Phys., received a diploma degree in physics at Hannover University (Germany) and a doctor’s degree at the University of Bayreuth (Germany). He then worked for 12 years as programme manager in an innovative German SME for efficient electric drive systems and energy technology, responsible for industrial projects and wind energy. Afterwards he joined the Fraunhofer Management GmbH for 5 years as manager of the division Technology and Innovation with a focus on technology consulting and management support. He then was a member of the management of the fuel cell system manufacturer Proton Motor Fuel Cell GmbH for 10 years as head of the sales division. In spring 2010 he joined Borit NV as Head of Sales.

**ROHWEDDER MICRO ASSEMBLY GMBH**

Rohwedder Micro Assembly is one of the leading companies for high accuracy industrial automation with appr. 60 employees located in Bruchsal. Rohwedder Micro Assembly (RMI) belongs to the Assembly in Motion Group, which also contains the Rohwedder Macro Assembly GmbH (RMA) and the Elwema Automotive GmbH with total appr. 280 employees.

From individual consultations to the conception and implementation of systems, as well as on-site-after-sales service, we assume responsibility for the entire process.
on behalf of our customers.

Rohwedder system solutions and standard products are used inter alia, in the automotive industry, telecommunications, medical technology, consumer, electronics as well as in the renewable energy industry.

In the last 5 years Rohwedder already participated in different research projects to increase the productivity of factory automation.

In order to fulfil the requirements of the product, the market and the customers it is very important to create an automation which is able to meet these demands starting upfront in the research phase of designing a SOFC.

**Main scientific contact person: Lothar Müller.** Degree in Electrical Engineering, field of feedback control systems, in 1983 at the University of Karlsruhe. He has worked over 8 years in engineering and programming of machines for automation production. He moved on to become the manager of different departments, e.g. Design, Service and Production. At present he is the leader of the project managing group at Rohwedder Micro Assembly.

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AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS

ICV is one of the 132 research centres of CSIC, The Spanish Research Council. ICV accounts with 150 persons, including 40 researchers in staff, around 40 PhD and post-doc researchers, 35 technicians and 10 management and administration personnel. It is organised in four departments: Ceramics, Electroceramics, Glasses and Physico-chemistry of surfaces and processes. The Glass Department of ICV founded in 1965 has become the most important research group in the field of glassy materials in Spain. The research group works with a double orientation: scientific research, financed with national public funds and technological research supported with contracts with companies and public projects of technological development as well. The concurrence among the objectives of both types of projects has been an incentive permitting to succeed in UE Framework Program calls where technological research and scientific excellence are required. An important objective is the international cooperation through agreements, EU
projects, concerted and integrated actions, cooperation projects, all reflected in a co-author publication rate of 70%. The personnel training carried out through PhD thesis and Degree and Master Projects, training courses and stages of foreign researchers in the group, as well as the dissemination and development of science and scientific culture are also major targets of this group.

The group has both equipment and infrastructure that is unique in the field, such as high-temperature viscometer (1550°C), and specific laboratories dedicated to the complete production and characterization of materials: high-temperature electric, gas and microwave furnaces (up to 1700°C), gradient and fibre furnaces, spectroscopic techniques (UV-visible-NIR, FTIR, optical ellipsometer with humidity control, Electrochemical Impedance Spectroscopy), coating characterisation (profilometer, roughness, ellipsometer), surface tension and contact angle, dilatometer, N2/O2 analysis, microhardness, refraction index, sol-gel lab and coating deposition facilities (automatic spray-coating, dip-coating, spin-coating, EPD, deposition with controlled humidity), added to the ICV facilities (HSM, FESEM, TEM, DRX, GAXRD, thermal conductivity, etc) and to the most complete library (books and journals) for glass, glass-ceramic and sol-gel materials in the country.

Topics connected to energy and environment research are the aim of most projects developed in the last 10 years. Different materials and components for fuel cells (PEMFC membranes, sealing glasses and glass-ceramics for MCFC and SOFC), solid electrolytes for Li-batteries, low temperature sealing of systems in solar energy devices and nuclear plants, come together with protective and environmentally friendly anticorrosive coatings, mesostructure coatings with photocatalytic activity for abatement of water or gas pollutants and solar cells, nano glass-ceramics with photonic applications, and energy saving, an important issue with different approaches, from industrial glass furnaces to solar and heat control glasses for buildings. The general objective is the design, processing and characterisation of glasses, glass-ceramics and sol-gel materials, going from the structural features to properties (optical, mechanical, chemical, thermal, electrical, etc) and applications.

**Main scientific contact: Dr. María Jesús Pascual**, PhD in Chemistry 1993 from Autonoma University of Madrid (UAM), Spain, and with Master thesis in Electrochemistry. She joined the Glass Department of the ICV (CSIC) in 1996 to develop her PhD thesis “Sealing glasses for molten carbonate fuel cells (MCFC)” in the framework of a European JOULE project. After several post-doctoral stages in several centres related with glass science and technology in Europe, she obtained a permanent position as Scientific Researcher in the ICV (CSIC) in 2007. At present, she is engaged in teaching in pos-doc masters and she supervises
Masters and PhD theses (one presented in 2006 devoted to glass-ceramic for sealing SOFC). She has participated in 11 national projects, 4 international projects and 8 cooperation projects and integrated actions. She is now principal researcher of one national project and one integrated action. She is co-author of 40 SCI papers most of them devoted to sealing glasses and glass-ceramics. She is the Secretary of the Glass Section of the SECV (Spanish Society of Ceramic and Glass). She has recently been awarded with the Gottardi Prize given by the International Commision on Glass.

Bekaert is a multinational company headquartered in Kortrijk, Belgium. Total sales are around 4000 Mio €/year and the number of employees are around 26,300. Bekaert’s mission is to achieve sustainable profitable growth through market and technological leadership. Products are defined by the two core competencies of the company, i.e. advanced metal transformation & advanced materials and coatings. The resulting product portfolio is very versatile and includes steel wire, cord, fibre, fabrics and composites. Bekaert serves different market segments in automotive, construction, energy, agriculture and other sectors. The Bekaert Fiber Technologies division has the capability to produce a wide range of fibre materials (various steels, hastelloy, Ni, etc. in diameter range 1.5 – 100 µm) which can be transformed into sintered products and textile fabrics. Applications of the fibre division include filtration elements, electro-conductive textiles, heat resistant separation materials, electrodes, etc.

Bekaert spends around 75 Mio€/year on research and development. 65% of these resources are located in two centralized R&D organizations (BTC in Belgium, Bardec in China). These organizations employ around 600 people in total; they are extremely well equipped with pilot facilities and lab characterization tools. The labs are ISO certified (9001, 14001).

Bekaert applies a professional project management approach (called the Bekaert Innovation Process = BIP) in all its innovation projects. The BIP is a stage gate process. In addition, Bekaert can rely on support from centralized services such as EH&S and IPD to give guidance in domains such as the environment, health, safety and patents.

Main Scientific contact person(s): Erik Dekempener, PhD in Physics. Currently
employed as Innovation Manager in the Bekaert Technology Center, he was previously employed by Philips Research Laboratories (NL) and Vlaamse Instelling voor Technologisch Onderzoek (VITO, BE). He has acquired more than 20 years of experience in various materials science domains such as thin films and surface treatments and has participated in various EU research projects and acted as project coordinator in two of them.

**Inge Schildermans**, PhD in Chemistry. Currently employed as Global Technology Manager of the Bekaert Fiber Technologies division. In that respect, she is responsible for all Bekaert R&D projects in the field of metal fibres. She has acquired a large expertise in all manufacturing processes and products incorporating metal fibres, including the application of fibre electrode materials for fuel cells and electrolysers.

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**TURBOCOATING S.P.A.**

Turbocoating is an independent and private held company. The core business is to develop special processes and manufacture protective coatings for components used in Industrial Gas Turbines (IGT) and Aero engines. Turbocoating can offer a wide range of surface treatment processes (thermal spray and CVD) and related services helping to choose the surface technology that best meets the required needs. Turbocoating is a leading company in research, development and production of special processes for high-tech components. 35 years experience in coatings enables the opportunity to support design schemes to ensure manufacturability of products and to endeavour for NCR free products.

Turbocoating has different thermal spray booths (3 VPS units, 3 LVPS(LPPS) and 6 APS/HVOF units, CVD plants and pack equipment for the production of diffusion aluminium coatings and MCrAlY over-aluminizing. Other related capabilities are: Blasting, Heat Treatments Vacuum/Air, High Temperature Vacuum Brazing, LASER machining, special surface finish techniques, Airflow testing, Water Flow testing, Moment weighing/balancing of rotating parts, Controlled Shot Peening, FPI, TIG welding, coating refurbishment, Mechanical and chemical stripping.

The product range of Turbocoating include: Blades, Vanes, Liners, Heat Shields, Burners, Tiles and Transition Parts.

Turbocoating was originally a division of FLAMETAL SpA (a coating facility founded...
in 1976 and sold to PRAXAIR in July 1999) which then became a separate independent company in September 1999. In general, the Turbocoating specialized staff consists of ~100 people of which 20% are engineers and approximately 80% of the staff speak English with many also speaking French and German.

The Stock Capital is 2 Million Euros and in 2009 the turnover was 19 Million Euros. Capital investments equal more than 22 Million Euros and most equipment is less than 6 years old. The Balance Sheets have been KPMG certified since 2003. A Joint-Venture between Turbocoating & Turbocare was formed in 2004 and named Turbo Service Torino (STT).

**Main scientific contact person: Dr. Andrea Scrivani** is R&D Manager and a member of the board of directors at Turbocoating S.p.A. and is also the president of ARTEC S.p.A., controlled by Turbocoating and dealing with the manufacturing of coating systems.

Dr. Andrea Scrivani has over 10 years of experience in the field of surface engineering and namely thermal spray coatings. He graduated in Mechanical Engineering in Parma University in 1996 and got the PhD in Materials Science and Technology in February 2002 at the University of Florence, while leading the R&D Department of Turbocoating S.p.A.

He started his activities in R&D department of Flametal SpA and joined Turbocoating SpA in January 2000 where he covered the position of R&D Manager and Technical Manager.

The focus of his work is coatings and surface treatments for several industrial applications: treatments to improve wear and corrosion resistance, thermal barrier and high temperature resistant coatings, treatments for repairing of serviced turbine blade and vanes.

He is author of more than 100 papers and international presentations published in technical journals and in proceedings of congresses on surface engineering, and is also author of several patents.

**SOLIDPOWER SPA**

SOLIDpower is a dynamic and rapidly progressing Italian company that develops
SOLIDpower manufactures high temperature electroceramic devices based on Solid Oxide Fuel Cells (SOFC) technology. SOLIDpower’s fuel cells can be used to provide electricity and sometimes heat in applications as diverse as housing (hot water, space heating and electricity), remote power where no electricity grid exists. The company was created in 2006 by carving-out the SOFC activities started in 2002 within the Eurocoating – Turbocoating Group, a privately-held group active in the fields of coatings and processes for gas turbines, machinery and biotechnology. In early 2007, SOLIDpower acquired 100% of HTceramix SA in Yverdon (Switzerland), a spin-off of the Swiss Federal Institute of Technology in Lausanne (EPFL). The vision of the company is to be a leading supplier of SOFC-based products.

SOLIDpower technology gives to the consumer an electric kilowatt-hours with a demonstrable electrical efficiency of 50 and a combining electricity and heat efficiency up to 90%. This data that should be compared to the efficiency of the electricity that comes from the traditional electrical network, which in Europe does not even reach 35%. The savings on bills is equivalent to that obtained using much more expensive interventions. Since they are remote-controlled, SOLIDpower generators can compensate local unbalances caused by the use of renewable resources, saving large investments on the electrical network. Benefits would fall upon the entire economy. The challenge Italy can take up is that of 1 GW of cogeneration to be installed in the country by 2020: the power of a nuclear power plant obtained through a system which can be monitored and controlled remotely.

SOLIDpower will take care of two main activity in the project: cells production, according to their processes, for further stack development and manufacturing by the partners. Long term stack’s testing focus on new design of stack cassette validation and to assess the stack’s degradation rate by the time.

For the industrialization of its products, SP built a pilot manufacturing plant for cells, stacks and SOFC generators in Mezzolombardo (TN, Italy) with a production capacity of 2 MW/year. The company is comprised of a young and motivated team of about 30 people.

Previous experience relevant to the role in the proposal: has a proprietary knowhow on SOFC cell and stack manufacturing, including unique expertise on the following processes relevant for the proposal: Water-based tape casting process, either for ceramic and metal powders, including thin and thick layer used in manufacturing anode supported cells; sintering, co-firing and oxidation processes; deposition of protective coatings to limit Cr evaporation; SOFConnex-based stack technology, including design, manufacturing and testing.
Selected Publications with relevance to the proposal:

D. Montinaro, S. Modena, S. Ceschini, M. Bertoldi, et al., “Anode supported solid oxide fuel cells with improved cathode/electrolyte interface”, presented at the 107th Annual Meeting & Exposition of The American Ceramic Society, Baltimore (USA), April 10-13, 2005


M. Bertoldi, T. Zandonella, V. Sglavo et al., “Protective coatings of metallic interconnects for IT-SOFC application”, presented at First European Fuel Cell Technology & Applications Conference (EFC05), December 14-16, 2005 in Rome, Italy


Previous funded projects (including activities of HTceramix to which SOFCpower has full access): European: RealSOFC (FP6 - Integrated Project, 2004-2008); RAMSES (FCH-JU 2009 call); LOTUS (FCH-JU 2009 call); ADEL(FCH-JU 2009 call); FlameSOFC (FP6 - Integrated Project, 2005-2009); SOFC600 (FP6 - Integrated Project, 2006-2010); ADOPTIC (FP6 - Collective Research Project, 2006-2009).


**Main scientific contact person: Massimo Bertoldi**, CTO, Ph.D. in Materials Engineering graduated from the University of Trento in 2004 and from 2004 to Feb 2007 was employed in Eurocoating’s R&D Dpt. as project leader of SOFC research. Since Feb 2007 he has worked as CTO of SP with responsibility for R&D activities, product development and setup of a pilot production plant in Italy including team selection and coordination. He is project leader of several National and European research projects and has more than 15 International scientific papers and patents published. He was a member of The Scientific Committee for the European Fuel Cell Forum 2008 in Lucerne (CH).
CONSORTIUM STRUCTURE AND PARTNER ROLES

The participating organisations are from four European countries. The eight participating legal entities are all independent of each other, although partners 6 and 7 have a common owner.

The project group consists of five industrial companies, of which three are SME, of two research centres, and a university.

The consortium was chosen to represent

- base technology providers (research centres),
- component manufacturers,
- equipment manufacturers, and
- groups representing system and product designers, acting as proxies for system integrators, OEM's and end users.

The consortium thus has all the expertise necessary in developing advanced SOFC stacks, tackling the challenges of efficiently and cost effectively manufacturing these, and at the same time securing practical relevance of the results without entering a binding and limiting liaison with a single OEM. Nevertheless, within the consortium several partners have the option and capability of directly commercialising project results.

More specifically the following tasks are attributed to the partners:

- JÜLICH is the project co-ordinator and supplies profound knowledge in SOFC materials and design; JÜLICH also owns technology to apply protective layers via WPS and galvanic methods, aside a number of other methods
- BORIT performs the manufacturing of the interconnects and partakes in the component design, including design-to-manufacturability and design-to-cost
- ROHW contributes the automation technology to reliably and reproducibly assemble stacks
- CSIC adds its expertise in glass sealant development to the JÜLICH materials work
- BEKAERT provides metal components used for contacting in lightweight stack designs TCOAT has industrially proven and established technology to apply plasma sprayed protective layers to steel interconnects; it also has possibilities for selected other coating technologies as necessary
- SPOWER is a manufacturer of SOFC cells and stacks with expertise from a variety of industrial development projects; SPOWER supplies part of the cells for manufacturing SRU’s, tests stacks and performs the cost and industrialisation analysis; SPOWER has the option to commercialise the technology developed in
the project

- UBHAM hosts a group looking into integration of electricity supply and drive trains into vehicle and energy supply systems; it will act as a proxy for OEM from a variety of application areas and as an independent institution deliver requirements and specifications for various applications from an objective point of view.