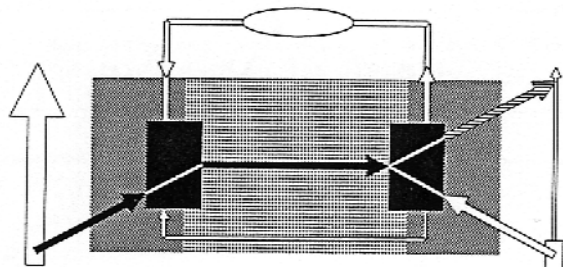


Final Report
Solid Oxide Fuel Cell Materials and Mechanisms
Joint Topical Meeting
16th. – 19th. January 2001.
Les Diablerets, Switzerland.

International Energy Agency



**Research, Development and
Demonstration of
Advanced Fuel Cells.**
Annex XIII: Solid Oxide Fuel Cells

European Science Foundation



EUROPEAN SCIENCE FOUNDATION

**Optimisation of Solid State
Electrochemical Processes for
Hydrocarbon Oxidation
(OSSEP)**

Summary report

The Topical Meeting here reported was the fourth in a series, alternating between Switzerland and Norway every two years, in which the basic sciences underlying solid oxide fuel cells and the materials required for them was given intensive consideration. The meetings also developed an awareness of the spinoff applications arising from SOFC R&D, particularly in the domains of high temperature catalysis, permselective membranes using ionic conduction in ceramics, and potential applications in fuel technology and chemical engineering.

Hitherto, these meetings have been organised within the series of Annexes on solid oxide fuel cells of the International Energy Agency (IEA) Implementing Agreement on Research, Development and Demonstration of Advanced Fuel Cells. As an innovation this time, and with the endorsement of the Executive Committee of the IEA Agreement and of the Steering Committee of the European Science Foundation (ESF) action OSSEP - Optimisation of Solid-State Electrochemical Processes for Hydrocarbon Oxidation, the Topical Meeting is a joint activity of both organisations. A particular recognition is due to ESF for the generous support of speakers from academic institutions within the OSSEP programme.

The programme of the Topical Meeting is attached below, from which is evident the technical quality of the presentation and the relevance to the ESF OSSEP programme. From the viewpoint of the International Energy Agency the absence of a participation - despite wide distribution of information - from non-European IEA member countries was a disappointment. Within the OSSEP programme however the participation was fully representative.

The communication of written reports for inclusion in a book of proceedings was very satisfactory, and the result was a representative record of the material presented by participants. The cooperation of the Research Centre, Jülich, Germany in the printing of the proceedings was particularly appreciated by the Editor.

The venue selected - an Alpine village in Winter - contributed significantly to the impact of the event on participants: there was effective interaction both on a social and also a professional level, giving a stimulus to the development of an OSSEP community. Contact made are expected to form the basis for further action within the overall OSSEP programme.

Augustin McEvoy,
Meeting Convenor.

Programme

Tuesday 16th. January 2001

17.00 – 19.00. Welcome and Registration.

19.00 Evening meal.

Wednesday 17th. January 2001

8.45 Formal opening: speakers: Marie Clifford-Gruber, ESF; Martin Ruëgsegger, Swiss Federal Office of Energy

9.00– 12.00 First technical session : Cathodes and oxygen reduction.

Kemal Nisancioglu, Norwegian University of Science and Technology, N-7491 Trondheim, Norway

A critical update on measurement of oxygen transport in ceramic oxides

Michel Prestat, Eidg. Tech. Hochschule ETHZ, CH-8092 Zurich, Switzerland.

Today's view of oxygen reduction at SOFC cathodes

Steven Scott, University of Edinburgh EH9 3JL, Scotland.

Characterisation and reactivity of LSCF cathodes.

Henny Bouwmeester, University of Twente, 7500 AE Enschede, Netherlands.

Thermodynamics and kinetics of defects in perovskite oxides $\text{La}_{1-x}\text{Sr}_x\text{Co}_y\text{Fe}_{1-y}\text{O}_{3-d}$

Werner Sitte, Technische Universitaet Graz, A-8010 Graz, Austria.

Transport properties and Nonstoichiometry of $\text{La}_{1-x}\text{Sr}_x\text{CoO}_3$ (LSC)

Stefan Diethelm, Ecole Polytechnique Fédérale de Lausanne, CH-1015 Lausanne, Switzerland

Oxygen transport and nonstoichiometry in $\text{La}_{0.4}\text{Ba}_{0.6}\text{Fe}_{0.8}\text{Co}_{0.2}\text{O}_{3-d}$.

Jorge R. Frade, University of Aveiro, 3810-193 Aveiro, Portugal

Microstructural effects and electrode processes of composite LaCoO_3 - $\text{La}_2\text{Zr}_2\text{O}_7$ cathodes deposited onto a GCO electrolyte.

12.15 – 16.15 Lunch, activities.

16.30 – 19.30 Second technical session : anodes and oxidation processes.

John T.S.Irvine, University of St Andrews, St Andrews, Fife KY16 9ST Scotland

Conductivity of Perovskite Materials for SOFC fuel electrodes

Richard Baker : University of Dundee, Dundee DD1 4HN, Scotland

Lanthanum chromite-based materials as anodes for methane oxidation in SOFCs - a brief review

Joseph Sfeir, Ecole Polytechnique Fédérale de Lausanne, CH-1015 Lausanne, Switzerland

LaCrO_3 - based anodes: stability considerations

Michael Joerger, Eidg. Tech. Hochschule ETHZ, CH-8092 Zurich, Switzerland.

Direct oxidation of hydrocarbons at catalytically active anodes

Duncan P.Fagg, Aveiro University, P-3810 Aveiro, Portugal

The applicability of $(\text{LaSr})(\text{FeTi})\text{O}_{3-\gamma}$ materials for SOFC anodes

Jose Ramon Jurado, Institute Ceramic and Glasses ICV-CSIC, E-28500 Madrid, Spain.

Samarium cobaltites as catalysts in methanol partial oxidation.

Jan Pieter Ouweltjes, Netherlands Energy Research Foundation, ECN, NL-1755 ZG Petten, Netherlands.

Oxide anode development at ECN

Dinner

Thursday 18th. January 2001

8.45 – 12.00 Third technical session : electrolytes.

Martin Kilo, TU Clausthal, D-38678 Clausthal-Zellerfeld, Germany.

Cation diffusion in stabilized zirconia: Experimental results and application to SOFC

Michael Lang, DLR Stuttgart, D-70569 Stuttgart, Germany

Development and characterisation of vacuum plasma sprayed thin film SOFC for reduced operating temperature.

Truls Norby, University of Oslo, N-0349 Oslo, Norway.

Defect – dopant association in ionic conductors.

Dainius Perednis, Eidg. Tech. Hochschule ETHZ, CH-8092 Zurich, Switzerland.

Thin electrolytes by spray pyrolysis

Elisabeth Djurado, Institut National Polytechnique de Grenoble, F-38402 St.-Martin d'Hères, France.

Nanocrystalline tetragonal zirconia films deposited by electrostatic spray deposition

Christos Argirusis, TU Clausthal, 38678 Clausthal, Germany

Cathode supported SOFCs with thin film electrolytes and interdiffusion phenomena

Alex. Cantlay, University of Edinburgh, Edinburgh EH9 3JL, Scotland

Preparation of thin films of lanthanum gallate

12.15 – 16.15 Lunch, activities.

16.30 – 19.30 Fourth technical session : materials and systems

Anja Bieberle, Eidg. Tech. Hochschule ETHZ, CH-8092 Zurich , Switzerland.

On the Way of Understanding the Electrochemistry of SOFC Anodes

Mogens Mogensen, Risoe National Laboratory, DK-4000 Roskilde, Denmark

Solid Oxide Fuel Cell Electrode Mechanisms

Peter Holtappels, Technische Universität Muenchen, D-85748 Garching, Germany

SOFC electrodes: materials aspects and trends for small scale SOFC systems

Beat Gut, Eidg. Materialien Prüfungsanstalt EMPA, CH-8600 Dübendorf, Switzerland

Materials for Anode Substrates

Serge Rambert, Ecole Polytechnique Fédérale de Lausanne, CH-1015 Lausanne, Switzerland

Operating conditions of stacks and consequences for materials

Jorge Frade / Filipe Figueiredo, Aveiro University, P-3810-193 Aveiro, Portugal

Effect of the reference position on overpotential measurements.

Dinner

Friday 19th. January 2001

9.00 Thematic talk : John A. Kilner, Imperial College of Science Technology and Medicine, England.

New oxygen ion and mixed conductors; Have we reached the limit?

Panel Discussion : reviews of each Technical Session.

Conclusion. IEA / ESF future activities.