

CRITICAL RAW MATERIALS ELIMINATION BY A TOP-DOWN APPROACH TO HYDROGEN AND ELECTRICITY GENERATION

Grant agreement no.: 721065

Start date: 01.01.2017 – Duration: 42 months

Project Coordinator: CNRS

DELIVERABLE REPORT

D.6.3 – ORGANISATION OF A WORKSHOP ON AEM- AND BM-BASED DEVICES FOR ELECTROCHEMICAL ENERGY CONVERSION

Due Date	31 st December 2019
Author(s)	N. Cros - PXO
Work Package	6
Work Package Leader	PXO
Lead Beneficiary	PXO
Date released by WP Leader	10 th December 2019
Date released by Coordinator	12 th December 2019

DISSEMINATION LEVEL

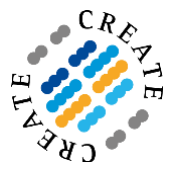
PU	Public	X
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

NATURE OF THE DELIVERABLE

R	Report	X
P	Prototype	
D	Demonstrator	
O	Other	

SUMMARY	
Keywords	EFCD2019 - Electrolysis and Fuel Cell Discussions conference, Towards Catalyst Free of Critical raw Materials for Fuel Cells and Electrolysers
	<p>CREATE jointly organised with the FCH JU CRESCENDO project (http://www.crescendo-fuelcell.eu) the second edition of the Electrolysis and Fuel Cell Discussions conference, EFCD2019, dedicated to catalysts with minimum amount of Critical Raw Materials, and in particular of Platinum Group Metals.</p> <p>This highly successful international conference was held at La Grande Motte in France, 15-18 September 2019. Attended by 160 international participants, it provided the opportunity to apprise the state of the art, showcase CREATE and CRESCENDO results and interact with other FCHJU/H2020 funded projects, including PEGASUS, which was invited to share a special session.</p>
Publishable Abstract (If different from above)	NA

REVISIONS			
Version	Date	Changed by	Comments
0.1	10 th December 2019	N. Cros (PXO)	Draft version
0.2	12 th December 2019	F. Jaouen (CNRS)	Final version



D6.3 – ORGANISATION OF A WORKSHOP ON AEM- AND BM-BASED DEVICES FOR ELECTROCHEMICAL ENERGY CONVERSION

CONTENTS

1. SCOPE & DISSEMINATION PROTOCOL	4
2. DESCRIPTION OF THE CONFERENCE	4
3. CONFERENCE PROGRAMME	6
4. CONFERENCE PUBLICATIONS	18
5. CONCLUSION	18

1. SCOPE & DISSEMINATION PROTOCOL

This deliverable report describes the International Conference jointly organised by CREATE and CRESCENDO projects (partners CNRS and PXO) "Towards Catalyst Free of Critical raw Materials for Fuel Cells and Electrolysers". The website for the conference may be found at <http://www.efcd2019.eu/>, see the screenshot below.

The banner features a large green and blue background with a scenic view of a harbor. The text reads: "2019 EFCD", "Electrolysis and Fuel Cell Discussions", "Towards Catalysts Free of Critical Raw Materials for Fuel Cells and Electrolysers", "15-18 September 2019", "La Grande Motte, France". Below the main banner is a row of five smaller images labeled "VENUE", "AUDITORIUM", "HOTEL", "BEACH", and "HARBOUR".

WELCOME TO EFCD2019

Following the success of EFCD2015 - Electrolysis and Fuel Cell Discussions, Challenges Towards Zero Platinum for Oxygen Reduction - in 2015, the Electrolysis and Fuel Cell Discussions conference in 2019 is dedicated to **catalysts with minimum amount of Critical Raw Materials**, and in particular of Platinum Group Metals.

Catalysis of the oxygen reduction and hydrogen oxidation reaction in fuel cells leaning on either proton-exchange or anion-exchange membranes is a key for enabling their large-scale deployment. Similarly, catalysis of the oxygen and hydrogen evolution reactions is key for electrolysers with polymer-based electrolytes.

This conference is the opportunity to present recent results in the field and to discuss the scientific and technological challenges on the way towards zero platinum. Invited lectures, oral and poster presentations will provide an international perspective of the most recent research activities in this

Conference Chairs

Dr. Deborah Jones
Dr. Frédéric Jaouen
CNRS Montpellier, France

2. DESCRIPTION OF THE CONFERENCE

This second edition of the conference under the banner Electrolysis & Fuel Cell Discussions was held at the Palais des Congrès in La Grande Motte. It focused on ultralow platinum catalysts (and catalyst layers) and catalysts free of critical raw material for fuel cells and electrolysers.

The meeting attracted 160 participants from 24 different countries. Most participants came from Europe (80%), the largest representation being from France, followed by Germany. Industry was well represented with 17 participants from the automotive or chemical industry and OEMs.

The most recent advances in the field were reported in 10 invited communications, 34 oral communications and more than 80 poster presentations. The invited speakers included Dr Piotr Zelenay (Los Alamos National Lab., USA) of the US ElectroCat consortium and Dr Alexey Serov, from Pajarito

Powder LLC, the only company to commercialise PGM-free catalysts at the present time. The complete list of invited speakers is given below.

- Lior Elbaz, Bar Ilan University, Israel
- Akimitsu, Ishihara, Yokohama National University, Japan
- Alex Martinez Bonastre, Johnson Matthey, United Kingdom
- William Mustain, University of South Carolina, USA
- Peter Pintauro, Vanderbilt University, USA
- Bryan Pivovar, National Renewable Energy Laboratory, USA
- Alexey Serov, Pajarito Powder LLC, USA
- Peter Strasser, Technical University Berlin, Germany
- Piotr Zelenay, Los Alamos National Laboratory, USA
- Iryna Zenyuk, University of California Irvine, USA

The meeting was organised in a single session, typically alternating between presentations on low PGM and non-PGM catalysts in alkaline and acid media during the four sub-sessions run every day. The key issues including new catalyst development and characterisation, development of characterisation methodologies in particular for active site and turnover frequency determination for PGM-free catalysts, and catalyst layer development with non-PGM catalysts were all addressed, as well as the crucial question of durability and catalyst ageing mechanisms. Lunches in the Palais des Congrès just a minute away from the conference room offered an excellent place for discussions.

The conference started with a welcome buffet reception and the first poster session on Sunday evening. On Monday morning, after the conference opening, the first invited talk was given by Professor Peter Strasser from Technical university of Berlin who focussed his lecture on the development of methodologies for active site determination in PGM-free catalysts. Three invited talks given by university or research institute scientists followed on Monday, on either low PGM or non-PGM catalysts for oxygen reduction, but also on low PGM catalysts for oxygen evolution. The second poster session was held on Monday evening. Tuesday morning was dedicated to the presentation of three projects – CREATE, CRESCENDO and PEGASUS - funded by the NMBP programme and Fuel Cell and Hydrogen Joint Undertaking (FCH-JU), a session open to all participants. In each case, a short overview of the project was followed by a focus presentation on one particularly successful or original aspect of the work. The three sessions following on Tuesday all included an invited lecture.

After a late afternoon break, all participants gathered for the conference dinner on the beach side, which was much enjoyed.

On Wednesday the three poster prizes were awarded after lunch. The conference closed after a final invited talk given by Professor Peter Pintauro.

Project partners from ITM, ICIQ, Jülich, AALto, as well as CNRS attended and presented results from CREATE, both orally and through posters, while PXO was in charge of the conference organisation.

3. CONFERENCE PROGRAMME

ORAL PROGRAMME

SUNDAY 15 SEPTEMBER 2019

- 15:00 - 19:00 Registration desk open
19:00 - 21:00 *Welcome buffet & Poster session 1*
-

MONDAY 16 SEPTEMBER 2019

Topic 01 - Non-PGM and ultralow PGM CATALYSTS (for ORR, PEMFC)

- 08:45 - 09:00 **Conference opening**
Dr. Deborah Jones & Dr. Frédéric Jaouen
- 09:00 - 09:40 **Plenary**
PGM-poor and PGM-free ORR fuel cell electrocatalysts
Peter Strasser, Technical University of Berlin, Germany
- 09:40 - 10:00 **Oral**
How Small: Selecting the right size of Pt Nanoparticles to enhance Their Oxygen Electroreduction Mass Activity
Batyr Garlyyev, Technical University of Munich, Germany
- 10:00 - 10:20 **Oral**
Novel Double Passivation Galvanic Displacement Method for Production of High-Performance Pt-alloy Electrocatalysts
Matija Gatalo, National Institute of Chemistry, Slovenia
- 10:20 - 10:40 **Oral**
Pd₃Y alloyed NPs prepared by Laser Ablation: towards zero platinum in PEMFC cathode catalysts
Riccardo Brandiele, University of Padova, Italy
- 10:40 - 11:00 **Coffee Break**
- 11:00 - 11:40 **Plenary**
Platinum Group Metal-Free Catalysts for Oxygen Reduction: State of the Art, Mechanistic Insights, and Challenges
Piotr Zelenay, Los Alamos National Laboratory, Los Alamos NM, USA
- 11:40 - 12:00 **Oral**
Active-site imprinting: Template ion reactions towards tailored Fe-N-C electrocatalysts
Tim-Patrick Fellingner, Technical University of Munich, Germany
- 12:00 - 12:20 **Oral**
What core@shell model studies can teach us about electrocatalysis?
Gartano Granozzi, University of Padova, Italy
- 12:20 - 14:00 **Lunch Break**

Topic 02 - Catalysts for anion-exchange membrane fuel cells

14:00 - 14:40

Plenary

New Catalysts and Electrode Designs for High Power, Long-Life AEMFCs

William Mustain, University of South Carolina, USA

14:40 - 15:20

Plenary

Advances in Low and Pt-free loading in Anion Exchange Membrane Fuel Cells

Bryan Pivovar, National Renewable Energy Laboratory, USA

15:20 - 15:40

Oral

Iron and nitrogen doped carbide-derived carbon/carbon nanotube composite catalysts for fuel cell cathodes

Kaido Tammeveski, University of Tartu, Estonia

15:40 - 16:00

Oral

Non-Precious Metal Nitrides as Novel Electrocatalyst for Enhanced Hydrogen Oxidation Reaction

Vineesh Thazhe Veetil, Bar Ilan University, Israel

16:00 - 16:20

Coffee Break

Topic 03 - Catalysts for anion- exchange membrane electrolyzers

16:20 - 16:40

Oral

High performance anion exchange membrane electrolysis using plasma-sprayed, non-precious metal electrodes

Andreas Friedrich, German Aerospace Center (DLR), Germany

16:40 - 17:00

Oral

Direct electrolysis of lignin in a continuous-flow Polymer Electrolyte Membrane reactor

Angel Caravaca, IRCELYON-CNRS, France

17:00 - 17:20

Oral

Water Dissociation Catalysis

Sebastian Oener, University of Oregon, USA

17:20 - 17:40

Oral

Degradation Mechanisms of Manganese Oxide Electrocatalysts - Guidelines for Alkaline Energy Conversion Devices

Florian Speck, Forschungszentrum Jülich GmbH, Germany

17:40 - 18:00

Oral

Soft X-ray Absorption Spectroscopy and Resonant Inelastic X-Ray Scattering as in situ Characterisation Tools for 3d Transition Metal Based Catalysts for OER

Marc Frédéric Tesch, Max Planck Institute for Chemical Energy Conversion, Germany

18:00 - 19:00

Break

19:00 - 21:00

Poster session 2 and reception

TUESDAY 17 SEPTEMBER 2019

H2020 FCH-JU session

- 09:00 - 09:15** **Oral**
CRESCENDO project Overview
Deborah Jones, CNRS Montpellier, France
- 09:15 - 09:35** **Oral**
Increasing population of oxygen reduction active sites in Fe-N/C catalysts
Asad Mehmood, Imperial College of London, United Kingdom
- 09:35 - 09:50** **Oral**
CREATE project Overview
Frédéric Jaouen, CNRS Montpellier, France
- 09:50 - 10:10** **Oral**
Novel strategies to enhance OER electrocatalysis in alkaline media
Jose Ramon Galan-Mascaros, Institute of Chemical Research of Tarragona (ICIQ), Spain
- 10:10 - 10:25** **Oral**
PEGASUS project Overview
Pierre-André Jacques, CEA Grenoble, France
- 10:25 - 10:45** **Oral**
Synthesis and characterization of Fe-N-C aerogel catalysts for oxygen reduction reaction
Sandrine Berthon-Fabry, MINES Paristech / PERSEE, France
- 10:45 - 11:00** *Coffee Break*
- 11:00 - 11:40** **Plenary**
The labyrinth around low PGM fuel cells for the electrification of the power train
Alex Martinez Bonastre, Johnson Matthey PLC, United Kingdom
- 11:40 - 12:00** **Oral**
Resistances in low-Pt-loaded catalyst layers from a mass transport and ionomer point of view
Adam Weber, Lawrence Berkeley National Laboratory, USA
- 12:00 - 12:20** **Oral**
Measurement of oxygen transport resistance of precious metal-free (PGM-free) catalyst layers in PEMFC
Yang-Shen Li, Technical University of Munich, Germany
- 12:20 - 14:00** *Lunch Break*
- 14:00 - 14:40** **Plenary**
Understanding Pyrolysis of PGM-free Electrocatalysts with Micro- and Nano- Synchrotron X-ray Computed Tomography
Iryna Zenyuk, University of California Irvine, USA
- 14:40 - 15:00** **Oral**
Insights into the Pyrolysis of Fe-N-C Electrocatalysts using High Temperature XAFS
Stephen Lyth, Kyushu University, Japan

- 15:00 - 15:20** **Oral**
Revealing the mechanism of active site formation in Metal-Nitrogen-Carbon catalysts
Andrea Zitolo, Synchrotron SOLEIL, France
- 15:20 - 15:40** **Oral**
X-ray Emission Spectroscopy Insights into the Spin State of Iron in Fe/N/C Catalysts
Kathrin Ebner, Paul Scherrer Institut, Switzerland
- 15:40 - 16:00** **Oral**
Quantum Chemical Investigation of Spectroscopic Properties of Fe-N-C model catalysts
Charlotte Gallencamp, TU Darmstadt, Germany
- 16:00 - 16:20** **Coffee Break**
- 16:20 - 16:40** **Oral**
Topic 03 - Catalysts for proton-exchange membrane electrolyzers
Multi-Component Ni-Ir Electrocatalysts toward Efficient Oxygen Evolution Reaction
Meital Shviro, Forschungszentrum Jülich GmbH, Germany
- 16:40 - 17:00** **Oral**
Spray-dried, Ultraporous Ir-based Catalyst for Proton Exchange Membrane Water Electrolyser
Jennifer Péron, Université Paris Diderot, France
- 17:00 - 17:20** **Oral**
Performance of [Mo₃S₁₃]₂- nanoclusters based cathodes in PEM water electrolysis – loading variation
Peter Holzapfel, Forschungszentrum Jülich GmbH, Germany
- 17:20 - 17:40** **Oral**
The Stability of Atomically Dispersed Pt Electrocatalyst
Michel Paul, Forschungszentrum Jülich GmbH, Germany
- 17:40 - 18:00** **Oral**
Operando X-ray Characterization of High Surface Area Iridium Oxides to Decouple their Activity Losses for the Oxygen Evolution Reaction
Juan Herranz, Paul Scherrer Institut, Switzerland
- 18:00 - 19:15** **Break**
- 19:30 -** **Banquet Dinner**

WEDNESDAY 18 SEPTEMBER 2019

Topic 01, non-PGM and ultralow PGM Catalysts

09:00 - 09:40

Plenary

Recent Advances in the Design of PGM-free Catalysts: From Molecular Catalysts to the State-of-the-Art Heat-Treated Atomically Dispersed Catalysts

Lior Elbaz, Bar Ilan University, Israel

09:40 - 10:00

Oral

Designing M-N/C Electrocatalysts with Preferentially Generated M-N_x Sites for Efficient Energy Conversion Electrocatalysis

Sang-Hoon Joo, UNIST, Republic of Korea

10:00 - 10:20

Oral

Effect of Partial Oxygen Pressure of Pt/Nb-SnO₂ Cathode Catalyst Layers on Load Cycle Durability for Polymer Electrolyte Fuel Cells

Makoto Uchida, University of Yamanashi, Japan

10:20 - 10:40

Oral

A Ti₃O₅Mo_{0.2}Si_{0.4}-based metal oxide support with enhanced conductivity and stability

Bradley Easton, Ontario Tech University, USA

10:40 - 11:00

Coffee Break

Topic 08 - Ageing and durability

11:00 - 11:40

Plenary

Are PGM-free Fuel Cell Catalysts Ready for Prime-Time?

Alexey Serov, Pajarito Powders LLC, USA

11:40 - 12:00

Oral

Atomically dispersed Fe-N-C active sites: chemistry, morphology, activity and stability insights

Plamen Atanassov, University of California Irvine, USA

12:00 - 12:20

Oral

Instability of Fe-N-C catalysts in acidic conditions

Chang Hyuck Choi, GIST, Republic of Korea

12:20 - 14:00

Lunch Break

14:00 - 14:40

Plenary

Oxygen Reduction Activity of Group 4 and 5 Oxide-Based Cathodes for Polymer Electrolyte Fuel Cells

Akimitsu Ishihara, Yokohama National University, Japan

14:40 - 15:00

Oral

Non-covalent integration of a Ni based molecular catalyst to graphene acid for efficient, noble-metal free, electrocatalytic H₂ oxidation

Bertrand Reuillard, CEA Grenoble, France

15:00 - 15:20

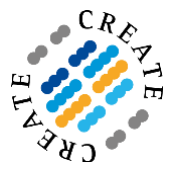
Coffee Break

15:20 - 16:00

Plenary

Recent Progress on Nanofiber Electrodes for Hydrogen/Air Fuel Cells

Peter Pintauro, Vanderbilt University, USA



16:00 - 16:20

Oral

Low cost ZIF-8 metal organic frameworks as precursor for Fe/N/C oxygen reduction catalysts

Carsten Cremers, Fraunhofer Institute for Chemical Technology (ICT), Germany

16:20 - 16:30

Close of Conference

POSTER PROGRAMME

Sunday 15 September 2019

Topic 01 - Non-PGM and ultra-low PGM catalysts – subtopic: Oxygen Reduction Reaction

Bhandari	Sabita	<i>Structural analysis of Pt in Pt/Fe-N-C catalyst for the oxygen reduction reaction in PEM fuel cells</i>	Max Planck Institute for Chemical Energy Conversion, Germany
Danilov	Michail	<i>Controlled Electrochemical Synthesis of the Partially Unzipped Multi-Wall Carbon Nanotubes for Electrodes of Fuel Cell</i>	National Academy of Science of Ukraine, Ukraine
De Sá	Maria Helena	<i>Passive direct methanol fuel cells as an alternative to the lithium batteries in portable applications: development of sustainable “eco-friendly” nanocatalysts</i>	Faculdade de Engenharia da Universidade do Porto, Portugal
Durante	Christian	<i>Converting mixed plastics into mesoporous Fe-N-C electrocatalyst active for oxygen reduction reaction in acidic electrolyte: the continuing challenge of active site formation and characterization</i>	University of Padova, Italy
Easton	E. Bradley	<i>Preparing model Fe-N/C active sites with molecular-level control</i>	Ontario Tech University, Canada
Ebner	Kathrin	<i>⁵⁷Fe-enrichment effect on the composition and performance of Fe-based O₂-reduction electrocatalysts</i>	Paul Scherrer Institut, Switzerland
Friedman	Ariel	<i>Achieving High Density of catalytic sites via Electropolymerization of Metallo Corroles</i>	Bar-Ilan University, Israel
Hülstede	Julia	<i>Biomass-Based Carbon Support for Non-Precious Metal ORR Catalysts</i>	DLR Institute of Networked Energy Systems, Germany
Lagrichi	Othman	<i>Platinum-Nickel Nanotubes Array as Cathode For PEMFC</i>	CEA Grenoble, France
Lilloja	Jaana	<i>Nitrogen-doped nanocarbons as catalysts for electroreduction of oxygen in alkaline solution</i>	Institute of Chemistry, University of Tartu, Estonia
Parnière	Alice	<i>Novel ORR electrocatalyst based on Pt-RE nanoparticles supported on nitrogen functionalised porous carbon</i>	ICGM-AIME, France

Primbs	Mathias	<i>Influence of carbon support modification on non-noble MNC catalyst for oxygen reduction reaction</i>	Technical University Berlin, Germany
Rana	Zahra	<i>Developing Low-Cost, M-N-C Electrocatalysts for the ORR in Low Temperature Fuel Cells</i>	University College London, United Kingdom
Ratso	Sander	<i>Fe-N-C catalysts prepared from carbide derived carbons for PEMFC cathodes</i>	Institute of Chemistry, University of Tartu, Estonia
Rojas	Sergio	<i>Effect of thermal treatment in the synthesis of Fe/N/C catalysts</i>	ICP-CSIC, Spain
Rossetti	Gabriele	<i>Towards stable and low-PGM fuel cell cathode with Hierarchical Nanostructured Thin Film (NSTF) as non-carbon support</i>	Istituto Italiano di Tecnologia, Italy
Roy	Aaron	<i>Atomically Dispersed Iron Nitrogen Carbon Catalysts with High Turnover Frequency for Oxygen Reduction Reaction in PEM Fuel Cells</i>	ICGM-AIME, France
Saida	Takahiro	<i>The Relationship between the Activity of Oxygen Reduction Reaction and the Distortion in Transition-metal Oxide Catalyst</i>	Meijo University, Japan
Santori	Pietro Giovanni	<i>Effect of Pyrolysis Atmosphere and Electrolyte pH on the Oxygen Reduction Activity, Stability and Spectroscopic Signature of Fe_{Nx} Moieties in Fe-N-C Catalysts</i>	ICGM-AIME, France
Sibul	Roberta	<i>Iron containing and nitrogen-doped graphene-based catalysts for the fuel cell cathode</i>	University of Tartu, Estonia
Sun	Shuhui	<i>Non-PGM electrocatalysts for PEM fuel cells: Origin of their instability</i>	INRS-Énergie, Matériaux et Télécommunications (INRS-EMT), Canada
Sun	Yanyan	<i>Confined Pyrolysis Synthesis of Fe-Coordinated Nitrogen-Doped Carbon Catalysts with Surface-Rich Fe-N_x Moiety to Boost the Oxygen Reduction Reaction in Acidic Media</i>	Technical University Berlin, Germany
Tasca	Federico	<i>Oxygen Reduction Reaction at Fe Catalysts with 4 or 5 Coordinated N Atoms. Calculated and Experimental O₂-Fe Binding Energy, Activity Indexes, Volcano Correlations</i>	Universidad de Santiago de Chile, Chile
Yarova	Svitlana	<i>NON-PGM metal-based Catalysts Based on MOFs and Electrospun Carbon Nanofibers</i>	ICGM-AIME, France
Zagoraïou	Eirini	<i>Highly and atomically dispersed Pt supported catalysts – Effect of properties on the electrocatalytic activity</i>	Institute of Chemical Engineering Sciences, FORTH-ICE/HT, Greece

Topic 01 - Non-PGM and ultra-low PGM catalysts – subtopic: Hydrogen Oxidation Reaction

Artero	Vincent	<i>Performances of ionomer-containing bio-inspired hydrogen fuel cell anodes: an interplay between surface chemistry and self-assembly at the mesoscale</i>	Université Grenoble Alpes and CEA Grenoble, France
Kitayev	Anna	<i>Non-Platinum catalyst for Hydrogen Oxidation Reaction in AMFC</i>	Bar Ilan University, Isarel
Novakova	Jaroslava	<i>Atomically dispersed platinum in ceria matrix for PEMFC anode</i>	Charles University, Czech Republic
Wolf	Sigrid	<i>Carbon supported ternary PdNiBi electrocatalysts for ethanol oxidation reaction in alkaline direct ethanol fuel cells</i>	Graz University of Technology, Austria

Topic 02 - Catalysts for proton- or anion-exchange membrane fuel cells

Blanchard	Pierre-Yves	<i>Platinum Free Cathode: Development of a Chemically Regenerative Redox Fuel Cell</i>	ICGM-AIME, France
Dionigi	Fabio	<i>Ternary Pt alloy catalysts for low Pt loaded fuel cell cathodes</i>	Technische Universität Berlin, Germany
Koyuturk	Burak	<i>Degradation, activity vs. loading and reaction mechanism of a non-precious ORR catalyst for PEMFCs</i>	Technical University of Munich, Germany
Li	Jingkun	<i>Engineering the 3D architecture of non-precious metal cathodes for practical H₂/air proton exchange membrane fuel cell applications</i>	ICGM-AIME, France
Lorenz	Julian	<i>Mesostructured Cobalt-Manganese-Oxides as Non-PGM Oxygen Reduction Catalyst in Anion Exchange Membrane Fuel Cells</i>	DLR Institute of Networked Energy Systems, Germany
Ott	Sebastian	<i>PGM-poor and PGM-free ORR fuel cell electrocatalysts</i>	Technical University of Berlin, Germany
Pham	Chuyen	<i>Performance of alkaline exchange membrane fuel cells using metal-free carbon-based oxygen reduction catalysts</i>	University of Freiburg, Germany
Roiron	camille	<i>Pt-free 3D-catalyst for proton exchange membrane fuel cells</i>	CEA Grenoble, France
Rojas	Sergio	<i>Fe/N/G catalysts for the ORR in acid electrolyte</i>	ICP-CSIC, Spain

Teppor	Patrick	<i>The influence of synthesis conditions to a facile Co-N/C type ORR catalyst synthesis method in RDE and fuel cell measurements</i>	University of Tartu, Estonia
Yang	Wonseok	<i>Performance analysis on ZIF-8 based non-PGM catalyst for oxygen reduction reaction in PEM fuel cells</i>	Korea University, Republic of Korea

Monday 16 September 2019

Topic 01 - Non-PGM and ultra-low PGM catalysts – subtopic: Oxygen Evolution Reaction

Arriaga Hurtado	Luis Gerardo	<i>Three-dimensionally ordered mesoporous material based on a trimetallic spinel (Mn_{0.5}Ni_{0.5}Co₂O₄) as oxygen bifunctional electrocatalyst</i>	Centro de investigación y desarrollo tecnológico en electroquímica, Mexico
Dam	An Phuc	<i>Exploring the Connection between Oxygen Evolution Reaction on Iridium Oxides and Catalyst Dissolution using Microkinetic Modelling</i>	Max-Planck Institute for Dynamics of Complex Technical Systems, Germany
Habrioux	Aurélien	<i>Noble metal-free catalysts for oxygen electrocatalysis in alkaline medium</i>	Institut de Chimie des Milieux et Matériaux de Poitiers, France
Ham	Kahyun	<i>The Role of Cation in Birnessite-like Mn Oxide toward Oxygen Evolution Reaction</i>	Gwangju Institute of Science and Techology, Republic of Korea
Retuerto	Maria	<i>ORR/OER Bifunctional Catalytic Activity of La_{1.5}Sr_{0.5}NiMn_{0.5}Ru_{0.5}O₆</i>	CSIC, Spain
Retuerto	Maria	<i>Na-doped Ruthenium Perovskites: Enhanced oxygen evolution activity and durability in acid media.</i>	CSIC, Spain
Slavcheva	Evelina	<i>Non-carbon supported Ni and Co catalysts for AEM water electrolysis</i>	Bulgarian Academy of Sciences, Bulgaria
Thorbjørnsen	Kristian Fredrik Klepp	<i>Iridium deposition by galvanic displacement of Cu in a one-pot configuration</i>	Norwegian University of Science and Technology, Norway

Topic 01 - Non-PGM and ultra-low PGM catalysts – subtopic: Hydrogen Evolution Reaction (and CO₂ reduction)

Ali	Syed Muhammad Farhan	<i>Investigation of alloys of transition metals with PGMs towards hydrogen-reactions</i>	Aalto University, Finland
------------	----------------------	--	---------------------------

Bagnall	Andrew	<i>Molecular-engineered electrodes incorporating cobalt catalysts for hydrogen evolution</i>	Univ Grenoble Alpes and CEA Grenoble, France
Dürr	Robin	<i>Efficient and Raw Material Free HER Catalysts Based on Doped ZIF Structures in Strong Acidic and Basic Conditions and Improvement with Co₂Mo₃O₈ Nanostructures</i>	CEA Paris Saclay/ Université Paris Saclay, France
Giuffredi	Giorgio	<i>Mesoporous CuOx-derived Nanostructured Copper Catalysts for CO₂ Reduction</i>	Istituto Italiano di Tecnologia, Italy
Giuffredi	Giorgio	<i>Bioelectrochemical TiN FDH Catalyst for CO₂ Reduction to HCOOH</i>	Istituto Italiano di Tecnologia, Italy
Giuffredi	Giorgio	<i>Self-supported, short range ordered Molybdenum Sulfide as high current density non-PGM HER catalyst</i>	Istituto Italiano di Tecnologia, Italy
Moroza	Adina	<i>Efficient and stable electrocatalytic hydrogen evolution on bioinspired bimetallic sulfide-based electrodes</i>	Univ. Grenoble Alpes-CNRS UMR 5249-CEA, France
Smiljanić	Milutin	<i>Hydrogen evolution reaction on model trimetallic Rh@Pd/Au(poly) catalyst</i>	National Institute of Chemistry, Slovenia
Topic 03 - Catalysts for proton- or anion-exchange membrane electrolyzers			
Backhouse	Rachel	<i>Challenges for Ultra-Low Platinum Group Metal Catalysts in PEM Water Electrolyzers</i>	ITM Power, United Kingdom
Holade	Yaovi	<i>Dual electrosynthesis of high purity hydrogen and organic molecules in a biomass-fuelled anion-exchange membrane electrolyzer</i>	Institut Européen des Membranes de Montpellier, France
Jiménez-Morales	Ignacio	<i>Activity-stability relation for iridium oxide nanoparticles deposited on doped tin oxide nanofibres as oxygen evolution catalysts for PEM water electrolysis</i>	ICGM-AIME, France
Marina	Riccardo	<i>Variation of intermetallic distance and OER activity in alkaline media of NiO rocksalt structure with Co inclusions</i>	Industrie De Nora, Italy
Spanu	Francesco	<i>Development of bipolar membrane electrode assemblies for fuel cell and electrolysis</i>	ICGM-AIME, France
Tuleushova	Nazym	<i>Free-standing nanostructured electrocatalysts for selective glycerol oxidation and water reduction as a pathway to dual carbon chemicals and H₂ fuel in low electricity consumption electrolyser</i>	Institut Européen des Membranes de Montpellier, France

Topic 05 and 06 - Modelling of catalytic sites and reaction pathways & Advanced characterisation techniques

Choi	Chang Hyuck	<i>Quantification of active sites in metal-nitrogen-carbon under electrochemical operating conditions</i>	GIST, Republic of Korea
Cornut	Renaud	<i>Mapping the intrinsic electrocatalytic activity of ORR catalysts with Scanning electrochemical microscopy</i>	CEA/NIMBE/LICSEN, France
Ghedjatti	Ahmed	<i>Electron Microscopy and Small Angle Neutron Scattering studies of bio-inspired catalytic layers for Proton-Exchange Membrane Fuel Cells</i>	CEA/DRF/BIG/LCBM, France
Han	Byungchan	<i>Design of Cost effective Electrocatalysts for Oxygen and Hydrogen Conversion Using First principles based Machine Learning Computing</i>	Yonsei University, Republic of Korea
Inaba	Masanori	<i>Benchmarking high surface area catalysts in a gas diffusion electrode: measurement of oxygen reduction activities under realistic fuel cell conditions</i>	Toyota Central R&D Labs., Inc., Japan
Kluge	Regina	<i>Identification of Active Electrocatalytic Sites Using Electrochemical Scanning Tunneling Microscopy</i>	Technical University of Munich, Germany
Luo	Fang	<i>Quantifying the Density and Utilization of Active Sites for PGM-Free Bimetallic Metal-Nitrogen-Carbon (BMNC) Oxygen Electroreduction Catalysts</i>	Technical University Berlin, Germany
Mechler	Anna K.	<i>Minute Amounts of Platinum Mitigate Radical Formation in Pt/Fe-N-C Hybrid Catalysts</i>	Max Planck Institute for Chemical Energyconversion, Germany
Ni	Lingmei	<i>Operando 57Fe Mößbauer Spectroscopy Study on a Fe-N-C Catalyst</i>	TU Darmstadt, Germany

Topic 07 - Mass-transport issues for non-PGM and ultra-low PGM loadings

Mabuchi	Takuya	<i>Molecular Analysis of Ionomer Aggregations During Drying Process of Alcohol/Water Mixtures</i>	Tohoku University, Japan
Talukdar	Krishan	<i>Innovative Way of Drying PEMFC Electrode</i>	German Aerospace Center, DLR, Germany

Topic 08 - Ageing and durability

Gonçalves	William	<i>Mechanical properties of Nafion membrane at nanoscale: from elasticity to rupture</i>	Tohoku University, Japan
------------------	---------	--	--------------------------

Kakinuma	Katsuyoshi	<i>Design of Low Pt loading Pt/Nb-SnO₂ Cathode Catalyst Layers with High Activity and Durability</i>	University of Yamanashi, Japan
Kaplan	Dima	<i>Effect of Ruthenium Contamination on the Activity of DMFC Cathode Catalyst</i>	Tel Aviv University, Isarel
Kim	Haesol	<i>Instability of platinum electrode in an electrochemical ammonia oxidation reaction</i>	GIST, Republic of Korea
Martinez-Bonastre	Alex	<i>Integration of Novel Stack Components for Performance, Improved Durability and Lower Cost</i>	Johnson Matthey, United Kingdom
Merzdorf	Thomas	<i>Carbon Corrosion Analysis in PEM Fuel Cells using a Non-Dispersive-Infrared System (ND-IR)</i>	Technical University Berlin, Germany
Rojas	Sergio	<i>Durability studies of Fe/N/C catalysts in acid and alkaline electrolytes</i>	ICP-CSIC, Japan

4. CONFERENCE PUBLICATIONS

A Topical Issue of the journal Springer Nature Applied Sciences entitled Material and Engineering Advances Towards Electrolyzers and Fuel Cells with Earth-abundant Elements is open to submissions from the conference participants, for publication early 2020.

5. CONCLUSION

The work on the conference Challenges for zero platinum for oxygen reduction and hydrogen oxidation launched in July 2018 culminated in a very visible and well-attended international conference in September 2019 that was attended by all the key researchers (national laboratories, universities, research institutes, industry) in the field. It provided the opportunity not only for CREATE and CRESCENDO, but also for other FCH JU/H2020 supported projects (e.g. PEGASUS, INSPIRE), to present their results in this international context. The conference was at the highest level of scientific and technical discussion and, just like its predecessor in 2015, sets the reference for future conferences in this field.

