



## Editorial

### Fuel Cells and Hydrogen: Break-up into the Future

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The 7<sup>th</sup> Fundamentals & Developments of Fuel Cells Conference (FDFC2017) was held in Stuttgart 2017 from January 30<sup>th</sup> to February 2<sup>nd</sup>. It was organized by the German Aerospace Center (DLR) with support from French Institutions University of Bourgogne Franche-Comté, University of Toulouse and Grenoble Institute of Technology. The FDFC2017 is part of an established series of conferences to discuss the scientific and technological progress in the area of fuel cells and hydrogen at the highest level. It is also a networking forum between scientists from universities and research institutions and representatives from industry to discuss the state of art and the remaining challenges for these important technologies in our future energy system. As in former events, the topics addressed are related to fuel cells and hydrogen and range from fundamentals of electrochemistry, cell and stack development, system design and control, to systems & field operation. Contributions to the conference are mainly related to polymer electrolyte cells and solid oxide cells.

Fuel cells and electrolyzers for hydrogen generation from renewable energy are acknowledged as essential parts of the necessary transition of the energy system, as required by the commitments to climate protection in the frame of COP21 and COP22. With the ratification of these agreements by more than hundred countries it is to be expected that fuel cell and renewable hydrogen will become important options for GHG emissions reduction in many parts of the world. Fuel cell development has reached an advanced maturity stage, as demonstrated by the first series cars from Asian manufacturers and the approaching commercialization of stationary systems in Europe as well as the successful market penetration of residential fuel cell systems in Japan. With the advancement of fuel cell car deployment a concurrent built-up of a hydrogen refueling infrastructure is needed. The first hydrogen infrastructure areas are located in California, Germany and Japan. However, in order to achieve a global reach, much more efforts are still needed worldwide.

With the large hydrogen and fuel cells programs in the United States, Europe, Japan and East Asia, many demonstration projects have been realized in the last years with significant technological achievements and apparent benefits for environment and users. However, also crucial bottlenecks have become apparent which still need to be overcome: efficiency, durability and reliability, and sustainable H<sub>2</sub> infrastructure, all under real operating and market conditions, for both transportation and stationary applications. Therefore, it is of paramount importance to continuously advance the technology further. Research activities to lower cost, improved durability and

reliability of both fuel cells and electrolyzers are necessary ingredients for further commercialization. It is also necessary for the research community to seek novel and game changing solutions. This pursuit involves intensive research effort at material, cell and stack levels, and in parallel improving systems performance, durability and reliability by optimal control. A functioning “ecosystem” in the R&D community requires the scientific discussion between diverse approaches: On one hand, the gradual improvement of current technology and on the other hand the pursuit of ground-breaking technology changes are both important for finding the most effective solutions for society (e.g., the revolution in batteries by the advent of Li-ion technology in the 1990s is such an example of changes which could not be predicted).

The scientific content of the conference followed this strategy, by providing sessions dedicated to the state-of-art, to the development of diagnostics to further advance and understanding the current technology, to identify degradation mechanisms and to find mitigation strategies for ageing. Furthermore, solutions for the pressing questions of today's technology and to progress the control and design of systems in real applications were important topics. On top of that, new materials (e.g., alkaline membrane for PEMFC) and new cell designs have been presented in dedicated sessions in the pursuit of finding ground-breaking solutions for cost reduction.

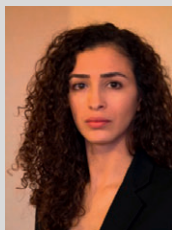
Plenary lectures were delivered by Prof. Henrik Lund from Aalborg University, Bart Biebuyck, FCH JU, Dimitrios Papageorgopoulos, U.S. Department of Energy, Dr. Deborah Jones, CNRS-Université de Montpellier, Prof. John TS Irvine, University of St Andrews, Prof. Michael Eikerling, Simon Fraser University, Prof. Ulrike Krewer, TU Braunschweig, Piotr Zelenay, Los Alamos National Laboratory, Pascal Maubarger, McPhy Energy Sa, Prof. Ludger Blum, Forschungszentrum Jülich.

This special issue of *Fuel Cells – From Fundamentals to Systems* contains selected papers presented at FDFC2017. The selection reflects the contents of the conference as well as the wide range of topics represented by the oral and poster contributions.

Finally, we wish to extend our thanks to the journal's Associate Editor, Dr. Petra Bele, for her tireless support as manager for the special issue, to all of the authors for their contributions and to the reviewers for their reviews and helpful comments and suggestions. We are also grateful for the support and encouragement of the Editorial Board of the journal in publishing the present issue.



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