

Distinguished Lectures at HZB

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## **Hydrogen and Ammonia as Energy Carriers and for Energy Storage - Progress and Perspectives**

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Wilhelm-Conrad-Röntgen-Campus

**14:00 o'clock**

# Hydrogen and Ammonia as Energy Carriers and for Energy Storage – Progress and Perspectives

Renewable energy conversion into chemical fuels is now recognized as a vital part of the future energy landscape – either as a means of smoothing the intermittency of renewable supplies, or as means of transporting large quantities of renewable energy around the world. Hydrogen and ammonia are two key chemicals at the epicenter of these new technologies. This talk will overview these developments as well as some of the materials and chemical science breakthroughs making them possible.

One of the most efficient routes to hydrogen is by electrolysis of water, otherwise known as water splitting. While the technology of water electrolysis is well established, significant advances in efficiency are required to make the process competitive in economic terms. Such advances in efficiency require improvements in catalysts for both the hydrogen evolution reaction (the “HER”) and the oxygen evolution reaction (“OER”). The OER is particularly sluggish and thus much attention has been devoted to understanding and developing new catalysts and media for this reaction.

Where the source of the renewable energy is geographically distant from population centers – “sometimes referred to as Stranded Renewables” – the issue of hydrogen storage and transportation arises. One solution to this challenge that is being explored is the use of “renewable” hydrogen to generate liquid ammonia, a chemical that is relatively easily and safely transportable by both pipeline and marine tankers. At point-of-use the ammonia can be converted simply and efficiently into hydrogen (and nitrogen). There is also growing interest in catalysts that could support the direct electro-reduction of atmospheric nitrogen to ammonia.

## CV

Professor Doug MacFarlane is an ARC Laureate Fellow at Monash University. He is also the program leader of the Energy Program in the ARC Centre of Excellence for Electromaterials Science. He holds Adjunct appointments at the University Alabama and Queens University Belfast. He was a PhD graduate from Professor Austen Angell's group at Purdue in 1982 and after postdoctoral fellowships in France and New Zealand took up an academic position at Monash

in 1983. He was appointed Professor of Chemistry in 1995 and served terms as Deputy Dean of Science 2000-2001 and as Head of School 2003-2006.

Professor MacFarlane was awarded an Australian Research Council Federation Fellowship in 2007 to extend his work on Ionic Liquids and then an ARC Laureate Fellowship in 2012 to continue this work in the field of protic ionic liquids. He was elected to the Australian Academy of Sciences in 2007 and to



the Australian Academy of Technological Sciences and Engineering in 2009. He is currently Chair of the Editorial Advisory Board of the *Australian Journal of Chemistry* and is a member of the Editorial Advisory Board of *Chemical Communications* - the flagship journal of the Royal Society of Chemistry. He is also a member of the Editorial Advisory Board of *Green Chemistry*.

Professor MacFarlane is a member of the Scientific Advisory Board of Cap-xx Ltd, Chair of the Scientific Advisory Board of Iteq Inc. and is a member of the Board of Governors of the International Society for Solid State Ionics. He has served on the Australian Research Council's Physical Sciences Expert Advisory committee. He serves on a panel of international experts that advises the German national science foundation.