

## Scope of the workshop

- Industrial perspectives and strategies in the field of hydrogen storage for stationary applications
- Current technical and market barriers, market requirements and status quo of hydrogen storage
- Presentation of main scientific and technical results of FCH JU projects BOR4STORE and EDEN on solid state hydrogen storage
- Identification of fields of advantageous application of solid state hydrogen storage

## Special Highlights

- Highly qualified invited speakers from industry and hydrogen research institutions
- Project coordinators giving a summary of the achievements and highlights of the projects
- Posters showing in detail individual research results of BOR4STORE project teams
- Visit of the BOR4STORE integrated SOFC - solid state hydrogen storage system
- Panel discussion to suggest future directions in hydrogen storage research and supporting the deployment of solid state and other alternative hydrogen storage technologies

## BOR4STORE Consortium

Dr. Klaus Taube, Helmholtz-Zentrum Geesthacht GmbH, Germany (Coordinator)

Abengoa Hidrógeno, SA, Sevilla, Spain; Zoz GmbH, Wenden, Germany; Katchem spol. s r.o., Prague, Czech Republic; Aarhus Universitet, Aarhus, Denmark; Institut for Energiteknikk, Kjeller, Norway; Università degli Studi di Torino, Torino, Italy; Eidgenössische Materialprüfungs- und Forschungsanstalt, Dübendorf, Switzerland; National Centre for Scientific Research "Demokritos", Athens, Greece

## Location of the Workshop

Instituto Cervantes Hamburgo  
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Fischertwiete 1, D-20095 Hamburg  
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## Responsible Organizers

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## Registration and Hotel Booking

The workshop is limited to ca. 100 participants on a first come, first serve basis. Please register via the website below or by contacting the Organizers until August, 31st, 2015. A hotel list will be provided upon request.

**Website to register:** [www.bor4store.eu/final-event](http://www.bor4store.eu/final-event)

Front cover: Crystal structure of  $\gamma$ (BH4)3 as determined from DFT calculations. © Copyright Prof. Zbigniew Lozdziana, Institute of Nuclear Physics, Krakow, Poland

INSTITUTE OF MATERIALS RESEARCH

## FCH JU Collaborative Project

# BOR4STORE – Hydrogen Storage for Stationary Applications

Workshop  
28.–29.09.2015



**“Fast, reliable and cost effective boron hydride based high capacity solid state hydrogen storage materials“**

## Who should attend?

- The workshop is targeted towards end users, developers, and scientists from industry and academia;
- Particularly users of hydrogen storage like energy producers with a need for energy storage, hydrogen suppliers, fuel cell producers, transport industry, and producers of autonomous energy and/or hydrogen consumers (e.g. telecom stations); and
- Decision makers from communities, authorities and standardization bodies.

## BOR4STORE Consortium



ABENGOA HIDROGENO



Helmholtz-Zentrum Geesthacht  
Centre for Materials and Coastal Research



## Acknowledgement of Financial Support

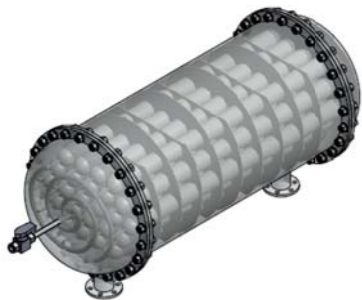
The organisers of the final event and the project partners thankfully acknowledge the financial support from the Fuel Cells and Hydrogen Joint Undertaking (FCH JU) under grant 303428.

## About

BOR4STORE followed an integrated, multidisciplinary approach for the development and testing of novel, optimised and cost-efficient boron hydride based hydrogen storage materials with superior performance for specific fuel cell applications.

Building on the results of past and ongoing EC funded projects on hydrogen storage, BOR4STORE tackled several challenges that hinder the practical use of the – due to their outstanding weight related hydrogen capacity – very attractive boron hydrides. The technical objectives involved

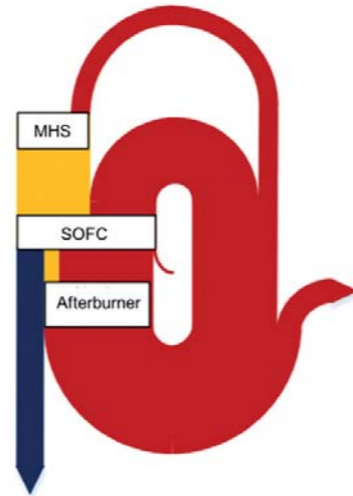
- new methods for the synthesis and modification of stable and unstable boron hydrides, as well as their combinations resulting in Reactive Hydride Composites and eutectic mixtures,
- systematic and rationalised investigation of the effect of special catalysts and additives, and
- adaptation of scaffolding concepts, in an attempt to use all possible ways for understanding and tailoring the key aspects of boron hydrides hydrogen storage performance (storage capacity, reaction pathways and enthalpies, hydrogenation/dehydrogenation kinetics, cycling stability).



Concept draft of solid-state hydrogen storage tank with tubular heat exchanger design.

The most promising material, as indicated by a rigorous down-selection process, was used for the development of a prototype hydrogen storage system that is integrated and tested in connection with a 1.3 kW Solid Oxide Fuel Cell (representative for fuel cell applications e.g. for stationary power supply).

Special attention was given to cost reduction by pursuing cost efficient material synthesis and processing routes but also by investigating the level of tolerable impurities of the new materials and use of recycling alloys for materials synthesis.



Sankey diagram scheme of heat flows in integrated SOFC-metal hydride store (MHS)-system.

## Programme

### Monday, September, 28

14:30 Welcome and Opening Remarks  
Dr. Klaus Taube, *Helmholtz-Zentrum Geesthacht GmbH, Germany (Coordinator)*

#### Message from the FCH JU

14:40 Importance of Hydrogen for Energy Storage – Results from FCH JU study  
Nikolaos Lymberopoulos, *FCH JU Project Manager*

#### Stationary Applications and Hydrogen Storage

15:10 Hydrogen production and use in renewable energy systems – implications for hydrogen storage  
*N.N., Abengoa Hidrógeno, S.A., Seville, Spain*

15:35 Hydrogen storage – requirements at retail stations and further upstream  
Dr. Jurgen Louis, *Shell Global Solutions International B.V., Hamburg*

16:00 Solide Oxide Cells – state of the art and use in renewable energy systems – implications for hydrogen storage systems  
Dr. Oliver Posdziech, *sunfire GmbH, Dresden, Germany*

16:25 Coffee Break

#### Storage technologies

16:55 Hydrogen storage based on Liquid Organic Hydrogen Carriers  
Daniel Teichmann, *Hydrogenious, Erlangen, Germany*

17:20 Low cost, low pressure, low temperature hydrogen storage systems  
Leonhard König, *GKN Sinter Metals Engineering GmbH, Radevormwald, Germany*

### FCH JU Projects BOR4STORE and EDEN

17:45 BOR4STORE – Development of Boron hydride based storage materials and integrated SOFC – MH-tank system  
Dr. Klaus Taube, *Helmholtz-Zentrum Geesthacht GmbH, Germany*

18:35 EDEN – Hydrogen Storage in a reversible Power-2-Power System  
Luigi Crema, *Fondazione Bruno Kessler, Trento, Italy*

#### Podium Discussion

19:00 Development needs for hydrogen storage systems – application and market potentials for hydrogen carriers  
Moderation: N.N.

19:30 Networking / Walking Dinner

### Tuesday, September, 29

#### Visits to E.on Windgas Hamburg Station and BOR4STORE Prototype

08:30 Meeting at Hafencity Refuelling Station

08:45 Bus-Transfer to E.on Windgas Hamburg Station, Hamburg-Reitbrook

09:15 Visit of E.on Windgas Hamburg Station

10:45 Bus-Transfer to HZG, Geesthacht

11:15 Detailed explanation and visit of BOR4STORE integrated SOFC – MH-Tank System

12:30 Opportunity for light lunch at HZG

13:30 End of the Workshop, Bus-Transfer back to Hamburg