École polytechnique fédérale de Lausanne (EPFL) Valais/Wallis
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ENERGYPOLIS SEMINAR

20. 04. 2016, 16:00 - 17:00, ENERGYPOLIS Sion, 4th floor, Seminar room

Complex Hydrides as room-temperature solid electrolytes for rechargeable batteries

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A central goal in current battery research is to increase the safety and energy density of Li-ion batteries. Electrolytes nowadays typically consist of lithium salts dissolved in organic solvents. Solid electrolytes could facilitate safer batteries with higher capacities, as they are compatible with Li-metal anodes, prevent Li dendrite formation, and eliminate risks associated with flammable organic solvents. Less than 10 years ago, $LiBH_4$ was proposed as a solid-state electrolyte. It showed a high ionic conductivity, but only at elevated temperatures. Since then a range of other complex metal hydrides has been reported to show similar characteristics.[1] Strategies have been developed to extend the high ionic conductivity of $LiBH_4$ down to room temperature by partial anion substitution[2] or nanoconfinement.[3]
At DTU Energy, we have performed a thorough study on $LiBH_4$, from the stability of its high temperature phase to characterization of all-solid-state lithium-ion[4] and lithium-sulfur batteries.[5]
Using a wide range of techniques, such as Quasi-elastic Neutron Scattering[6], Positron Annihilation, Nuclear Magnetic Resonance and Electrochemical Measurements, we have studied the mechanisms of the lithium mobility and identified some fundamental principles giving opportunities for all-solid-state batteries development and opening new research direction on solid electrolyte based on complex hydrides.

References:

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[3] D. Blanchard, A. Nale, D. Sveinbjörnsson, T. M. Eggenhuisen, M. H. W. Verkuijlen, Suwarno, T. Vegge, A. P. M. Kentgens, P. E. de Jongh, *Adv. Funct. Mater.* **2015**, *25*, 184.
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[6] J. S. G. Myrdal, D. Blanchard, D. Sveinbjörsson, T. Vegge, *J. Phys. Chem. C* **2013**, *117*, 9084.

D. Blanchard

D. Blanchard is, since 2013, Senior Researcher at the Technical University of Denmark, Department of Energy Conversion and Storage (Group leader Tejs Vegge). He joined the group in 2008, as postdoctoral researcher and then scientist. His research focuses on materials for energy storage: solid-electrolytes, metal hydride batteries, ammonia storage and hydrogen storage in complex hydrides. He developed this later field of research while being postdoctoral researcher in Bjorn Hauback's group at the institute for Energy Technology, Norway. D. Blanchard received his Ph.D. from the Université Joseph Fourier, Grenoble (France), after a university curriculum in applied physics, geophysics and atmospheric chemistry.