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, LiBH₄ 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.[3] Strategies have been developed to extend the high ionic conductivity of LiBH₄ down to room temperature by partial anion substitution[4] or nanoconfinement.[5] At DTU Energy, we have performed a thorough study on LiBH₄, from the stability of its high temperature phase to characterization of all-solid-state lithium-ion[6] 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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