Full-cell hydride-based solid-state Li batteries for energy storage - DTU Orbit (25/02/2019)

Full-cell hydride-based solid-state Li batteries for energy storage

Metallic and complex hydrides may act as anode and solid electrolytes in next generation of lithium batteries. Based on the conversion reaction with lithium to form LiH, Mg- and Tibased anode materials have been tested in half-cell configuration with solid electrolytes derived from the hexagonal high temperature modification of the complex hydride LiBH4. These anode materials show large first discharge capacities demonstrating their ability to react with lithium. Reversibility remains more challenging though possible for a few dozen cycles. The work has been extended to full-cell configuration by coupling metallic lithium with positive electrodes such as sulfur or titanium disulfide through complex hydride solid electrolytes. Beside pure LiBH4 which works only above 120 °C, various strategies like substitution, nan confinement and sulfide addition have allowed to lower the working temperature around 50 °C. In addition, use of lithium closo-boranes has been attempted. These results break new research ground in the field of solid-state lithium batteries. Finally, operando and in-situ neutron scattering methods applied to full-cells are presented as powerful tools to investigate and understand the reaction mechanisms taking place in working batteries.

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