CONDUCTIVITY AND STABILITY ENHANCEMENT OF MAGNESIUM BOROHYDRIDE CONTAINING ISOPROPYLAMINE USING NANOCONFINEMENT

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Abstract

As we are phasing out fossil fuels, it has become clear that for mobile applications, the current battery technology has neither the energy nor the power density to replace current fuels. To overcomes these challenges, new battery materials must be developed. The major drawbacks of the current lithium-ion technology are the inability to use a metal anode, the flammable nature of the organic electrolyte, and the durability. To overcome the dendrite formation issue seen in lithium systems, other cations can be considered.[1]

In 2017 Roedern et al. showed that coordinating ethylenediamine to magnesium borohydride increased ionic conductivity by a factor 10^5 and demonstrated magnesium stripping and plating in a Pt/Mg(en)$_1$(BH$_4$)$_2$/Mg cell.[2] Since then, magnesium borohydrides have shown greatly increased ionic conductivities when coordinated to neutral ligands such as ammonia,[3] diglyme,[4] ammonia borane[5] and now isopropylamine. In the project, it was found that a new crystalline compound (Mg(BH$_4$)$_2$·2-(CH$_3$)$_2$CHNH$_2$) was formed upon the addition of isopropylamine. A second compound (Mg(BH$_4$)$_2$·-(CH$_3$)$_2$CHNH$_2$) was synthesised by ball milling Mg(BH$_4$)$_2$ and Mg(BH$_4$)$_2$·2(CH$_3$)$_2$CHNH$_2$ in a 1:1 molar ratio. Ball milling these new compounds in a 1:1 molar ratio yielded a highly conductive compound reaching an ionic conductivity of 2.7×10^{-4} Scm^{-1} at 45 °C, whereafter the sample became soft. By adding 75 wt% MgO nanoparticles, the activation energy of the compound was decreased from 1.17 to 0.56 eV. Furthermore, mechanical and thermal stability also increased.[6]

References

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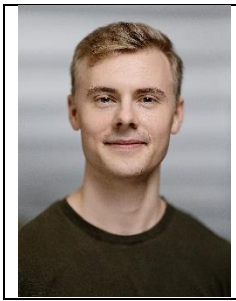
Biography



My name is Lasse. I am a master's student in Torben R. Jensen's group. Furthermore, my bachelor's thesis and nanoscience project were also conducted in this group. My work has mainly focused on adding different neutral ligands to metal borohydrides, in an attempt to increase ionic conductivity. Both my bachelor and master's degree were conducted at the interdisciplinary iNANO centre, where I gained insight into many different fields of study.