

## DEVELOPMENT OF COMPLEX HYDRIDES FOR FAST IONIC CONDUCTION

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Complex hydrides have been attracting much attention as solid-state fast ionic conductors since we reported the fast lithium ionic conduction in  $\text{LiBH}_4$  [1]. The development of fast ionic conductors is important because of their potential applications as solid electrolytes in rechargeable batteries [2]. We have worked on the development of lithium ionic conductors as well as sodium ionic conductors of complex hydrides.

$\text{Na}_2\text{B}_{12}\text{H}_{12}$ , composed of the  $[\text{B}_{12}\text{H}_{12}]^{2-}$  closo-borate anions shown in Fig.1, exhibits superionic conductivity on the order of 0.1 S/cm above its order-disorder phase-transition at about 530 K [3]. The rapid reorientational motions of the anions, evidenced by the NMR and QENS measurements, play an important role in the formation of the cation-vacancy-rich structures in the high-temperature disordered phase. In addition, three-dimensional conduction pathways are formed in the crystal lattices.  $\text{Na}_2\text{B}_{10}\text{H}_{10}$  is also a superionic conductor displaying ionic conductivity of 0.01 S/cm over 380 K triggered by the rapid reorientational motions of the  $[\text{B}_{10}\text{H}_{10}]^{2-}$  anions [4]. From the application point of view, it is highly desirable to enhance the conductivities of  $\text{Na}_2\text{B}_n\text{H}_n$  at room temperature. In this study, we report combining  $\text{Na}_2\text{B}_n\text{H}_n$  with  $\text{NaNH}_2$  is effective in modifying the conductivities of  $\text{Na}_2\text{B}_n\text{H}_n$ .

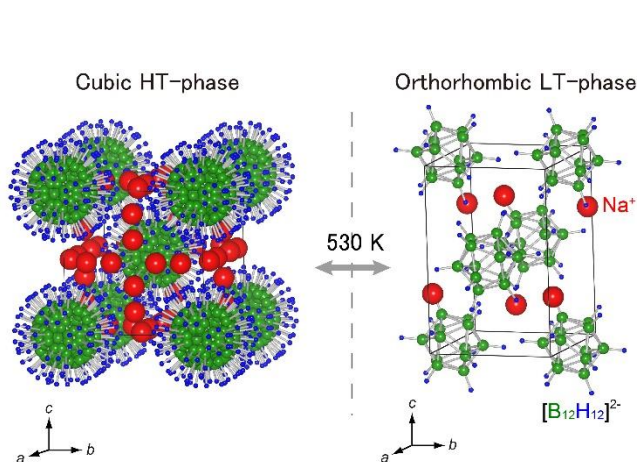


Figure 1 Crystal structures of  $\text{Na}_2\text{B}_{12}\text{H}_{12}$  in orthorhombic LT phase and cubic HT phase.

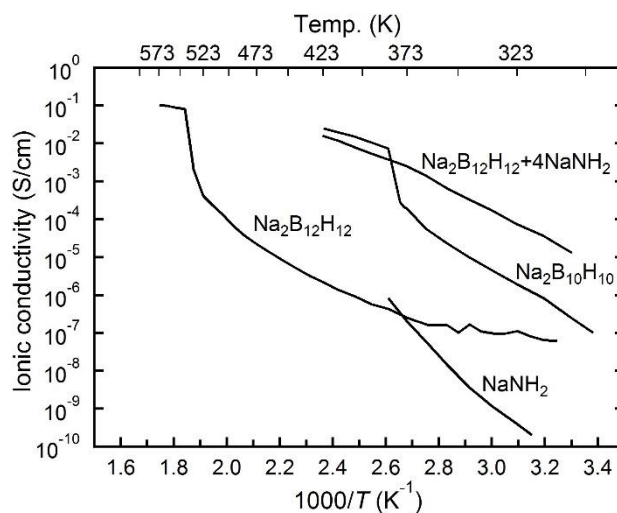


Figure 2 Temperature dependences of the sodium ionic conductivity of complex hydrides.

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