DEVELOPMENT OF COMPLEX HYDRIDES FOR FAST IONIC CONDUCTION

Motoaki Matsuo, School of Science and Technology, Kwansei Gakuin University
matsuo35@kwansei.ac.jp
Norihiro Matsubara, School of Science and Technology, Kwansei Gakuin University
Noboru Katayama, School of Science and Technology, Kwansei Gakuin University
Hayato Asano, School of Science and Technology, Kwansei Gakuin University
Kengo Sawada, School of Science and Technology, Kwansei Gakuin University
Shin-ichi Orimo, Advanced Institute for Materials Research, Tohoku University

Key Words: complex hydride, fast ionic conductor

Complex hydrides have been attracting much attention as solid-state fast ionic conductors since we reported the fast lithium ionic conduction in LiBH₄ [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.

Na₂B₁₂H₁₂, composed of the [B₁₂H₁₂]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. Na₂B₁₀H₁₀ is also a superionic conductor displaying ionic conductivity of 0.01 S/cm over 380 K triggered by the rapid reorientational motions of the [B₁₀H₁₀]²⁻ anions [4]. From the application point of view, it is highly desirable to enhance the conductivities of Na₂BₙHₙ at room temperature. In this study, we report combining Na₂BₙHₙ with NaNH₂ is effective in modifying the conductivities of Na₂BₙHₙ.

References