Synthesis and Characterization of Zinc-Nanoparticle-Supported Hydrogen Boride Nanosheets

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Hydrogen boride (HB) nanosheets are two-dimensional materials composed of hydrogen and boron.[1] Owing to their potential applications in hydrogen storage[2] and carbon dioxide (CO_2) conversion reactions,[3] HB nanosheets have attracted increasing attention as promising material that can contribute to realizing a decarbonized society. Furthermore, it has been reported that HB can reduce certain metal ions upon simple mixing, producing metal Nanoparticles that are subsequently immobilized in a highly dispersed state on the HB nanosheets.[4, 5] This unique reductive and dispersive capability also highlights their potential in catalytic applications.

Cu/Zn-based catalysts are widely used for methanol synthesis from CO_2. If Cu/Zn bimetallic nanoparticles can be highly dispersed on the surface of HB nanosheets (Cu/Zn/HB), Cu/Zn/HB could be a novel and promising catalytic platform for CO_2-to-methanol conversion. However, despite their ability to reduce Cu^{2+} ions to form Cu nanoparticles, HB nanosheets cannot reduce Zn^{2+} to Zn metal because of the mismatch in their redox potentials.

In this study, as a first step toward realizing Cu/Zn/HB, we investigated the synthesis of Zn/HB by employing an external reducing agent to form Zn nanoparticles on HB nanosheets (Fig. 1). The details of the preparation and subsequent characterization of the resulting Zn/HB will be discussed.

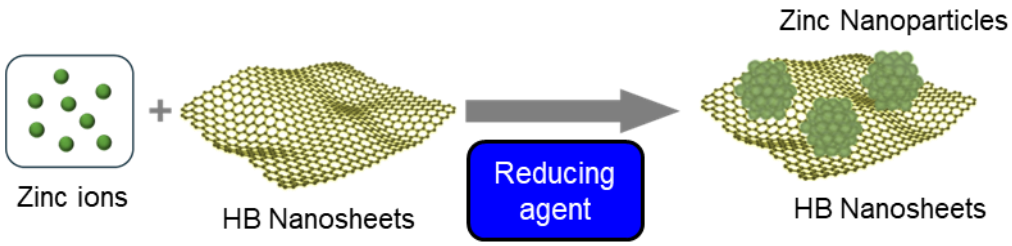

Fig. 1 Schematic illustration of the synthesis procedure for Zn/HB

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