Abstract

Hydrogen storage materials are an important component of the future hydrogen economy, because they provide a high gravimetric energy density solution to the hydrogen storage problem. We all know a future need of energy storage material for H_2 because of hydrogen advantage over other alternatives (for example, accessible portability, high energy density). Many researchers are still working on this project and explored many storage materials, in which metal boride is one of the desirable options for its low molar mass, high gravimetric H_2 capacity, and approachable cyclic H_2 storage capability.

Much research has been done on the layered magnesium diboride over the last decade, in which they are found to be cyclic H_2 storage, but due to high pressure(950 bar) and high temperature(450^{o}C) require for hydrogenation and high temperature(597^{o}C), require for dehydrogenation. IIT-GN has successfully developed many methods to exfoliate the MgB_2 to develop the boron-based honeycomb plane functionalized with hydride, oxide, and hydroxy functional groups. This work uses MgB_2 2D nanostructure for H_2 Storage material, as the hydride functional group is present on its surface.

The hydrogenation and dehydrogenation on a chemically activated MgB_2 2D nanostructure were performed in this work to find out the potential of the MgB_2 derived nanosheets as MgB_2 already showed as exceptional cyclic H_2 storage material. The Liquid Phase Exfoliated Nanosheets (LPE-NS) and Dissolution and Recrystallization Nanosheets (DR-NS) both methods exhibit more than 6 wt% of H_2 storage capacity, and 100 % desorption of hydrogen was observed in the temperature range of 400-500 ^{o}C.

During the synthesis of MgB_2 2D nanostructure, we found continuous H_2 desorption, which makes us proceed one step forward and enhance the H_2 generation during recrystallization of the functionalized MgB_2 precursor formed during the reaction between MgB_2 and H_2O.