

# 炭素ドーピングホウ化水素シートの合成と評価

## Synthesis and evaluation of carbon-doped HB sheet

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Recently, we have revealed that the hydrogen boride (HB) sheet can be experimentally prepared by exfoliation and complete ion-exchange between protons and magnesium cations in magnesium diboride ( $\text{MgB}_2$ ) at room temperature (Fig. 1) [1]. Our extensive analysis revealed that the HB sheets did not show any long range order, but have a local structure of a hexagonal boron network with bridge hydrogens. HB sheets release their hydrogen as  $\text{H}_2$  molecules by UV irradiation even at room temperature [2], while hydrogen can also be released by heating in a wide temperature range from 423 to 1473 K [1]. Theoretically, the release temperature of hydrogen by heating is expected to be lower by electron doping to HB, because of the electron occupation of anti-bonding orbital of H-B bonds by electron doping [3].

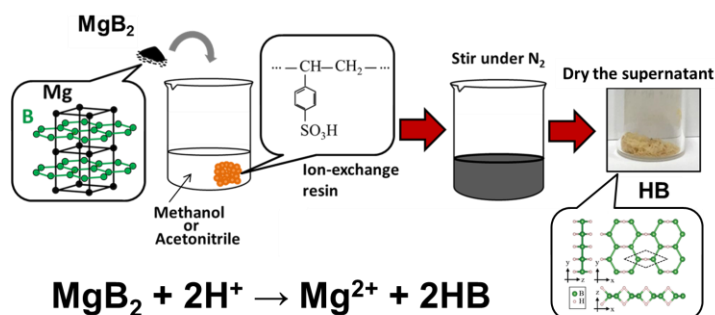
In this work, we have prepared carbon doped (C-doped) HB sheets by using C-doped  $\text{MgB}_2$  as a starting material for ion-exchange reaction (Fig. 1) and analyze its geometric and electronic structures as well as hydrogen release property. By controlling the dopant amount in the C-doped  $\text{MgB}_2$  as 2%, 4% and 10%, we have controlled the dopant amount in C-doped HB.

In the presentation, we will report on the results of X-ray photoelectron spectroscopy, work function measurements, thermal desorption spectroscopy, and transmission electron microscopy as well as the theoretical calculation results about geometric and electronic structures of C-doped HB.

[1] H. Nishino, et al., *J. Am. Chem. Soc.* **139**, 13761 (2017).

[2] R. Kawamura, et al., *Nat. Commun.* **10**, 4880 (2019).

[3] T. A. Abtew, P. Zhang, *Phys. Rev. B*, **84**, 094303 (2011).



**Fig. 1** Schematic image of the synthesis procedure of hydrogen boride (HB) sheets. The same procedure was applied to synthesize the C-doped HB by using C-doped  $\text{MgB}_2$