Researchers at Tokyo Institute of Technology, University of Tsukuba, and colleagues in Japan report a promising hydrogen carrier in the form of hydrogen boride nanosheets[1]. This two-dimensional material, which has only recently begun to be explored, could go on to be used as safe, light-weight, high-capacity hydrogen storage materials.

Innovative nanosheets made from equal parts of hydrogen and boron have a greater capacity to store and release hydrogen compared with conventional metal-based materials.

This finding by researchers at Tokyo Institute of Technology (Tokyo Tech), University of Tsukuba, Kochi University of Technology and the University of Tokyo reinforces the view that hydrogen boride nanosheets (HB sheets) could go beyond graphene as a nano-sized multifunctional material.

Their study, published in *Nature Communications*, found that hydrogen can be released in significant amounts (up to eight weight percent) from HB sheets under
ultraviolet light, even under mild conditions — that is, at ambient room temperature and pressure.

Such an easy-to-handle setup opens up possibilities for HB sheets to be utilized as highly efficient hydrogen carriers, which are expected to become increasingly in demand as a clean energy source in the coming decades.

When HB sheets burst onto the scene in 2017, scientists recognized they could become an exciting new material for energy, catalysis and environmental applications. The breakthrough research garnered plaudits for its creative approach to materials design. A review article published in Chem in 2018 hailed the successful realization of HB sheets as “an exquisite example of human ingenuity at the pinnacle of innovative synthetic chemistry.”

HB sheets are expected to be applied for light-weight, light-responsive, and safe hydrogen carrier. Currently, HB sheets are only responsive to ultra-violet light, thus, the visible-light sensitivity is important for their industrial application.

Also, refilling of hydrogen remains a key challenge in developing sustainable, viable hydrogen storage solutions. To address this issue, Miyauchi explains his team is investigating the visible-light sensitivity, rechargeability, and long-term durability of HB sheets.

“Cost reduction of the starting materials — magnesium diboride — for HB sheets will be another important factor,” he adds.

The cross-institutional study showcases the predictive power of first-principles calculations[2] in materials science, namely as a way of investigating the mechanism of hydrogen release.

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Technical terms

[1] hydrogen boride nanosheets: Two-dimensional materials derived from magnesium diboride (MgB₂) that were first reported by researchers in Japan in 2017. The nanosheets exhibit extraordinary electronic and mechanical properties in addition to hydrogen storage capacity.

[2] First-principles calculations: Referring to a way of calculating mechanical, electronic or other properties of a given material based on the laws of quantum mechanics, which can lead to useful, predictive results prior to experimentation.

References

Reiya Kawamura¹,², Nguyen Thanh Cuong³,⁸, Takeshi Fujita³, Ryota Ishibiki⁴, Toru Hirabayashi¹, Akira Yamaguchi¹, Iwao Matsuda⁵, Susumu Okada², Takahiro Kondo ⁶,⁷,*

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**Affiliations**

1 Department of Materials Science and Engineering, Tokyo Institute of Technology  
2 Department of Physics, Faculty of Pure and Applied Sciences, University of Tsukuba  
3 School of Environmental Science and Engineering, Kochi University of Technology  
4 Graduate School of Pure and Applied Sciences, University of Tsukuba  
5 Institute for Solid State Physics, University of Tokyo  
6 Department of Materials Science and Tsukuba Research Center for Energy Materials Science, Faculty of Pure and Applied Sciences, University of Tsukuba  
7 Materials Research Center for Element Strategy, Tokyo Institute of Technology  
8 These authors equally contributed to this work.

*Corresponding authors’ emails: mmiyauchi@ceram.titech.ac.jp, takahiro@ims.tsukuba.ac.jp

**Related links**

Miyauchi Lab.  
[http://www.eim.ceram.titech.ac.jp/HomeE.html](http://www.eim.ceram.titech.ac.jp/HomeE.html)

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**Contact**

Emiko Kawaguchi  
Public Relations Section,  
Tokyo Institute of Technology  
E-mail: media@jim.titech.ac.jp  
+81-3-5734-2975

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