Research findings could enable high-density hydrogen storage for future energy systems

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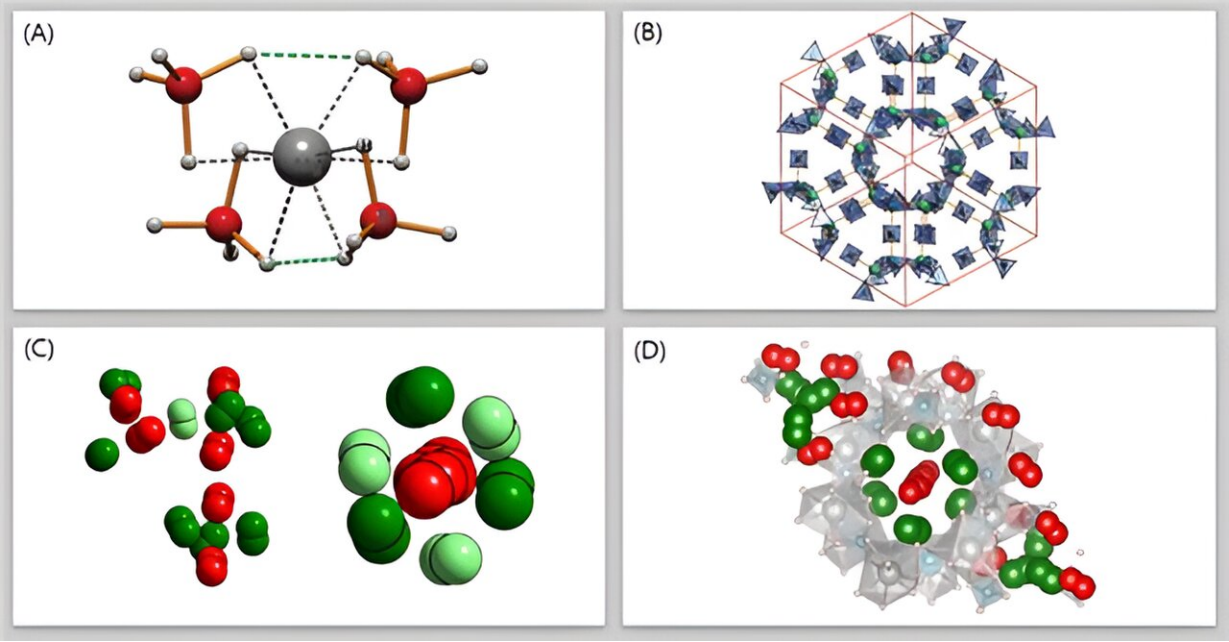

The structure of magnesium borohydride and its high-density hydrogen adsorption state. Credit: Ulsan National Institute of Science and Technology

A development in efficient hydrogen storage has been reported by Professor Hyunchul Oh in the Department of Chemistry at UNIST, marking a significant advancement in future energy systems.

This innovative research centers around a nanoporous magnesium borohydride structure ($Mg(BH_4)_2$), showcasing the remarkable capability

to store hydrogen at high densities even under normal atmospheric pressure. The study is published in *Nature Chemistry*.

The research team, under the leadership of Professor Oh, has successfully tackled the challenge of low hydrogen storage capacity by leveraging advanced high-density adsorption technology. Through the synthesis of a nanoporous complex hydride comprising magnesium hydride, solid boron hydride $(BH_4)_2$, and magnesium cation (Mg^+), the developed material enables the storage of five hydrogen molecules in a three-dimensional arrangement, achieving unprecedented high-density hydrogen storage.

The reported material exhibits an impressive hydrogen storage capacity of 144 g/L per volume of pores, surpassing traditional methods, such as storing hydrogen as a gas in a liquid state (70.8 g/L). Additionally, the density of hydrogen molecules within the material exceeds that of the solid state, highlighting the efficiency of this novel storage approach.

Professor Oh emphasizes the significance of this breakthrough, stating, "Our innovative material represents a paradigm shift in the realm of hydrogen storage, offering a compelling alternative to traditional approaches." This transformative development not only enhances the efficiency and economic viability of hydrogen energy utilization but also addresses critical challenges in large-scale hydrogen storage for public transportation applications.

More information: Hyunchul Oh et al, Small-pore hydridic frameworks store densely packed hydrogen, *Nature Chemistry* (2024). DOI: 10.1038/s41557-024-01443-x

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