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Magnesium Hydride Holds Key for Storing Hydrogen

To make fuel cells practical, efficient ways must be found to transport hydrogen, an essential fuel for the cells. This issue is especially important for applications involving automotive and mobile equipment, where added weight and volume are significant drawbacks. At normal temperatures, hydrogen is a gas. In that form, hydrogen takes up too much volume to make it easily transportable. Hydrogen can be compressed and stored in high-pressure cylinders. However, such cylinders must be very strong. Hydrogen can be also stored in liquid form in small tanks. For that, however, hydrogen must be cooled to very low temperatures.

Bio Coke Lab., Ltd. has developed another method for making hydrogen easy to store and transport. This involves magnesium hydride. This substance is solid at normal temperatures and can be turned into powder or clusters. One gram of magnesium hydride can store approximately 1.8L of hydrogen, which can theoretically produce 4.5 watt-hours of electric power. To trigger production of hydrogen, all are needed are moisture and warmth. Thus, hydrogen can be extracted efficiently by immersing the magnesium hydride in warm water. When hydrogen is produced, magnesium hydroxide ultimately precipitates and can be collected easily. No catalyst is required if the chemical reaction takes place at 70°C or higher, but hydrogen can be produced at even lower temperatures by using catalysts or ultrasound.

The company has commercialized three furnaces for forming magnesium hydride from magnesium and hydrogen, says Dr. Hiroshi Uesugi, President, Bio Coke Lab., Ltd. The No. 1 furnace can produce 20g of magnesium hydride in one cycle, the No. 2 furnace can produce 5kg, and the No. 3 furnace can produce 50kg, achieving the annual production capacity of approximately 7 tons. The company is developing the No. 4 furnace for producing 500kg, the No. 5 furnace for producing 5 tons, and the No. 6 furnace for performing continuous operation, says Uesugi.

The hydrogen is produced mainly from biomass. Magnesium is taken from seawater. Seawater containing a high concentration of magnesium can be obtained from the desalination process, which is increasingly common. Afterwards, magnesium can be extracted by subjecting this seawater to electrolysis.

Also, collected magnesium hydroxide might be recycled and made into magnesium hydride once more.

Efforts in making magnesium hydride a suitable replacement for petroleum become inevitable.

Magnesium hydroxide is presently used as an additive for resin and rubber, and high-purity magnesium hydroxide is also used as a sealant for ICs. In Japan alone, 40,000 to 50,000 tons of magnesium hydroxide are produced annually. It is possible that facilities for manufacturing magnesium hydroxide may be used to produce both magnesium hydroxide and magnesium hydride. "The price of magnesium hydride is ¥40 to ¥60 (US$0.40 to US$0.70) per gram today, and we hope to reduce the price to about ¥1 in the future. We believe that magnesium hydride can become a large-scale business to be able to replace the petroleum industry, as well as a clean energy source," says Uesugi. **JEI**