Nano-graphite may store H2 gas

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Graphite films only nanometers or billionths of a meter thick could help store hydrogen in an inexpensive, easily manufactured, lightweight and nontoxic manner, an international team of scientists told UPI's Nano World.

"If -- and that's a very large if -- a practical method for preparing the nanostructures can be found, there is a possibility for large-scale, economical production," said researcher John Tse, a materials scientist at the University of Saskatchewan in Saskatoon.

Government and industry leaders are convinced hydrogen will prove a key fuel in the future, with a five-year $1.2 billion U.S. initiative announced in 2003 to develop hydrogen fuel cells and Shell Oil committing $1 billion over five years, according to plans they announced in 2001. This is because hydrogen is the most common element, making up roughly three-quarters of the known universe, while fossil fuels are limited.In addition, the chemical reaction needed for hydrogen cars combines hydrogen with oxygen to produce energy and water, with none of the dirty mix of toxins and global warming gases burning gasoline spews.

"The use of hydrogen as a fuel in which the combustion product is water will help to reduce the emission of greenhouse gases that are detrimental to the environment," Tse said.

The problem of how to store hydrogen remains the Achilles' heel for a hydrogen economy, however.The desired end is a cheap device no

heavier and no bulkier than a traditional gasoline tank that provides enough hydrogen to power a vehicle for at least 300 miles before refueling.This is challenging, because storing hydrogen often demands extreme cold, heat or pressure, which requires equipment that is heavy, bulky or expensive.

Researchers already have devoted significant efforts toward exploring carbon-based materials to store hydrogen, such as carbon nanotubes that could suck up hydrogen much as water is drawn up through a straw.Scientists also have investigated graphite, but prior theoretical models suggested it could store hydrogen only poorly.

Tse and colleagues at the Steacie Institute for Molecular Sciences in Ottawa and the Technical University of Dresden in Germany reinvestigated graphite via mathematical models and found the prior studies were incomplete when it came to exploring interactions between carbon and hydrogen on a quantum level.They found graphite layers spaced slightly less than a nanometer apart can store hydrogen at room temperature and moderate pressures at close to a good weight.So the researchers contend graphite is a better option than carbon nanotubes, because it is far easier and less expensive to prepare.Another good possibility is the use of porous carbon foams.The findings appear in this week's Proceedings of the National Academy of Sciences.

"These calculations suggest many new experiments.This paper suggests that these areas ought to be revisited," Michael Heben, a materials scientist at the National Renewable Energy Laboratory in Golden, Colo.,, told Nano World.