Scientists discover recycling method to advance fuel cell practicality

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(PhysOrg.com) -- The use of hydrogen as a practical, widespread alternative fuel to gasoline took another step today as researchers from Los Alamos National Laboratory and The University of Alabama announce a method for recycling a hydrogen fuel source.

The scientists demonstrate that a lightweight material, ammonia borane, can be a feasible material for storing hydrogen on vehicles, according to an article publishing in the March 18 issue of *Science*. In the upcoming article, researchers describe an efficient method of adding hydrogen back into the material once the alternative fuel is spent.

"This is a critical step if we want to use hydrogen as a fuel for the transportation industry," said Dr. David Dixon, the Robert Ramsay Chair of Chemistry at The University of Alabama and one of the article's co-authors.

In this approach, ammonia borane in a fuel tank produces hydrogen which, when combined with oxygen in the vehicle's fuel cell, releases energy. That energy is then converted to electricity that powers an electric motor. Water is the only emission.

After hydrogen is released from the ammonia borane, a residue, which the researchers refer to as "spent fuel," remains.

"The spent fuel stays in the car, and we need to add hydrogen back to it in order to use it again," Dixon says. "What this paper describes is an efficient way to add the hydrogen back to make the ammonia borane again. And it can be done in a single reactor."

Practical, efficient and affordable storage of hydrogen has been one of the challenges in making the powering of electrical motors via hydrogen fuel cells a viable alternative to traditional gasoline powered engines. Benefits of hydrogen fuel cell technology include cleaner air and less dependence on foreign oil.

Today's announcement of a successful "fuel regeneration process," as the scientists call it, overcomes one key hurdle.

The experimental work was done at Los Alamos and the computer modeling work was done in Dixon's University of Alabama lab. UA co-authors with Dixon are Edward "Ted" B. Garner III, a University graduate student from Florence; J. Pierce Robinson, a UA undergraduate from Atmore; and Dr. Monica Vasiliu, a UA alumna from Romania who is working with Dixon as a post-doctoral researcher.

The article's lead author is Dr. Andrew D. Sutton of Los Alamos National Laboratory. Other Los Alamos co-authors are Drs. Anthony K. Burrell, John C. Gordon, Tessui Nakagawa and Kevin C. Ott.

While there has been much progress toward making the widespread use of hydrogen fuel cell technology practical, Dixon said other challenges remain.

"The basic three steps - the initial synthesis, the controlled release of hydrogen, and the regeneration of fuel - are actually in pretty good shape. The next piece is to get a cheap source of hydrogen that doesn't come from coal or fossil fuels.

"The biggest hurdle which we, and everybody else in the world, are looking at is 'how do I use solar energy efficiently to split water in order to make hydrogen and oxygen.'"

Provided by University of Alabama