Hydrogen fuel closer to reality because of storage advances

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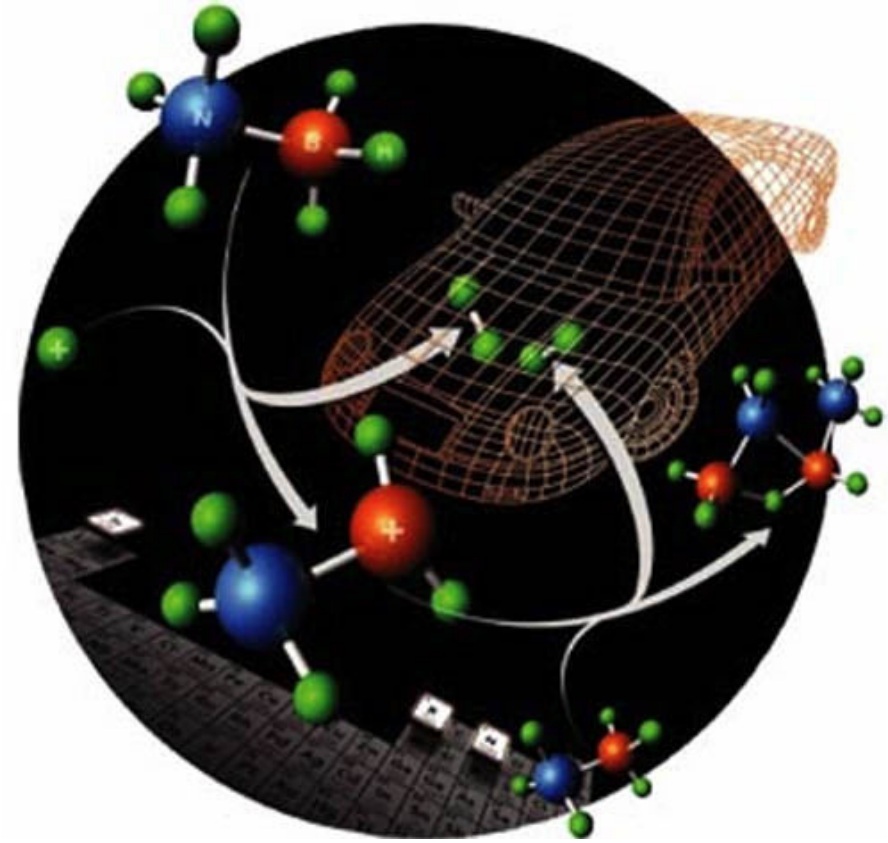

Drive toward hydrogen vehicles just got shorter

A significant advance in hydrogen storage could make hydrogen a more attractive fuel for vehicles or other transportation modes.

Researchers revealed the new single-stage method for recharging the hydrogen storage compound ammonia borane. The LANL technology focuses on using ammonia borane as a "chemical storage tank" for hydrogen fuel.

An ammonia borane system could allow hydrogen to be easily extracted for use in hydrogen fuel cell batteries and then be recharged with hydrogen over and over.

Vehicles could travel more than 300 miles on a tank

The development could allow a vehicle to travel more than 300 miles on a single "tank" of fuel, which is a benchmark for the U.S. Department of Energy. The method represents a significant step toward practical use of hydrogen in fuels.

In an article in the March 18 edition of Science magazine, LANL and University of Alabama researchers working within the U.S. Department of Energy's Chemical Hydrogen Storage Center of Excellence describe a significant advance in hydrogen storage science.

Hydrogen as an ideal fuel but needs improved storage

Hydrogen is in many ways an ideal fuel. It possesses a high energy content per unit mass when compared to petroleum, and it can be used to run a fuel cell, which in turn can be used to power a very clean engine.

On the down side, H2 has a low energy content per unit volume versus petroleum (it is very light and bulky). The crux of the hydrogen issue has been how to get enough of the element on board a vehicle to power it a reasonable distance.

Ammonia borane boosts hydrogen storage capacity

Work at LANL and elsewhere has focused on chemical hydrides for storing hydrogen, with one material in particular, ammonia borane, taking center stage. Ammonia borane is attractive because its hydrogen storage capacity approaches a whopping 20 percent by weight—enough that it should, with appropriate engineering, permit hydrogen-fueled vehicles to go farther than 300 miles on a single "tank," a benchmark set by the U.S. Department of Energy.

Hydrogen release from ammonia borane has been well demonstrated, and its chief drawback to use has been the lack of energy-efficient methods to reintroduce hydrogen into the spent fuel once burned. In other words, until now, after hydrogen release, the ammonia borane couldn't be recycled efficiently enough.

Simple scheme reduces expense, complexity of the recycle stage

The Science paper describes a simple scheme that regenerates ammonia borane from a hydrogen depleted "spent fuel" form (called polyborazylene) back into usable fuel via reactions taking place in a single container.

This "one pot" method represents a significant step toward the practical use of hydrogen in vehicles by potentially reducing the expense and complexity of the recycle stage.

Regeneration takes place in a sealed pressure vessel using hydrazine and liquid ammonia at 40 degrees Celsius and necessarily takes place off-board a vehicle. The researchers envision vehicles with interchangeable hydrogen storage "tanks" containing ammonia borane that are used, and sent back to a factory for recharge.