Hydrogen breakthrough could open the road to carbon-free cars

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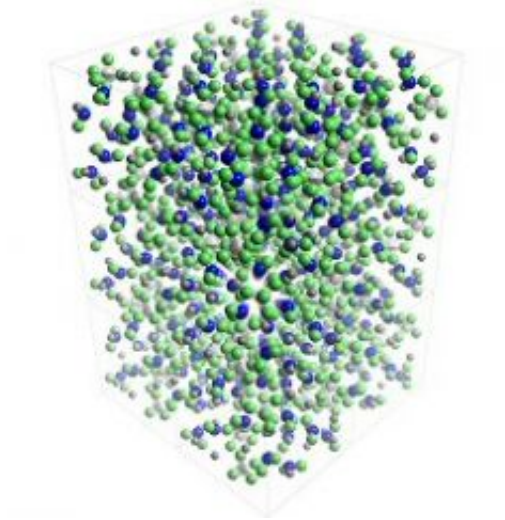

Illustration showing how hydrogen atoms are absorbed into the new storage material. Hydrogen atoms are shown in green, lithium atoms in dark grey, nitrogen atoms in blue and boron atoms in grey. Credit: University of Oxford

A new breakthrough in hydrogen storage technology could remove a key barrier to widespread uptake of non-polluting cars that produce no carbon dioxide emissions.

UK scientists have developed a compound of the element lithium which may make it practical to store enough hydrogen on-board fuel-cell-powered cars to enable them to drive over 300 miles before refuelling. Achieving this driving range is considered essential if a mass market for

fuel cell cars is to develop in future years, but has not been possible using current hydrogen storage technologies.

The breakthrough has been achieved by a team from the Universities of Birmingham and Oxford and the Rutherford Appleton Laboratory in Oxfordshire, under the auspices of the UK Sustainable Hydrogen Energy Consortium (UK-SHEC). UK-SHEC is funded by the SUPERGEN (Sustainable Power Generation and Supply) initiative managed and led by the Engineering and Physical Sciences Research Council (EPSRC).

Fuel cells produce carbon-free electricity by harnessing electrochemical reactions between hydrogen and oxygen. However, today's prototype and demonstration fuel-cell-powered cars only have a range of around 200 miles.

To achieve a 300 mile driving range, an on-board space the size of a double-decker bus would be needed to store hydrogen gas at standard temperature and pressure, while storing it as a compressed gas in cylinders or as a liquid in storage tanks would not be practical due to the weight and size implications.

The UK-SHEC research has therefore focused on a different approach which could enable hydrogen to be stored at a much higher density and within acceptable weight limits. The option involves a well-established process called 'chemisorption', in which atoms of a gas are absorbed into the crystal structure of a solid-state material and then released when needed.

The team has tested thousands of solid-state compounds in search of a light, cheap, readily available material which would enable the absorption/desorption process to take place rapidly and safely at typical fuel cell operating temperatures. They have now produced a variety of lithium hydride (specifically $Li_4BN_3H_{10}$) that could offer the right blend

of properties. Development work is now needed to further investigate the potential of this powder.

“This could be a major step towards the breakthrough that the fuel cell industry and the transport sector have waited for,” says UK-SHEC’s Project Co-ordinator Professor Peter Edwards of the University of Oxford. “It’s due to SUPERGEN’s vision of combining many of the leading groups in the UK to tackle this, arguably the biggest challenge for the development of hydrogen fuel cell vehicles. This work could make a key contribution to helping fuel cell cars become viable for mass-manufacture within around 10 years.”

Source: Engineering and Physical Sciences Research Council