Hydrogen tank lighter than battery

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Dutch-sponsored researcher Robin Gremaud has shown that an alloy of the metals magnesium, titanium and nickel is excellent at absorbing hydrogen. This light alloy brings us a step closer to the everyday use of hydrogen as a source of fuel for powering vehicles. A hydrogen 'tank' using this alloy would have a relative weight that is sixty percent less than a battery pack. In order to find the best alloy Gremaud developed a method which enabled simultaneous testing of thousands of samples of different metals for their capacity to absorb hydrogen. The British company Ilika in Southampton has shown considerable interest.

Hydrogen is considered to be a clean and therefore important fuel of the future. This gas can be used directly in cars in an internal combustion engine, like in BMW's hydrogen vehicle, or it can be converted into electrical energy in so-called fuel cells, like in the Citaro buses in service in Amsterdam.

The major problem of using hydrogen in transport is the secure storage of this highly explosive gas. This can be realised by using metals that absorb the gas. However, a drawback of this approach is that it makes the hydrogen 'tanks' somewhat cumbersome.

The battery, the competing form of storage for electrical energy, comes off even worse. Driving four hundred kilometres with an electric car, such as the Toyota Prius, would require the car to carry 317 kilos of modern lithium batteries for its journey. With Gremaud's light metal alloy this same distance would require a hydrogen tank of 'only' two hundred kilos. Although this new metal alloy is important for the

development of hydrogen as a fuel, the discovery of the holy grail of hydrogen storage is still some way off.

Hydrogenography

In his research Gremaud made use of a technique for measuring the absorbance of hydrogen by metals, based on the phenomenon of 'switchable mirrors' discovered at the VU University Amsterdam. About ten years ago researchers at the VU discovered that certain materials lose their reflection by absorbing hydrogen. This technique became known as hydrogenography, or 'writing with hydrogen'. Using this technique, Gremaud was able to simultaneously analyse the efficacy of thousands of different combinations of the metals magnesium, titanium and nickel. Traditional methods require separate testing for each alloy.

The analysis requires each of the three metals to be eroded from an individual source and deposited onto a transparent film in a thin layer of 100 nanometres using so-called sputtering deposition. This ensures that the three metals are deposited onto the film in many different ratios. When the film is exposed to different amounts of hydrogen, it is clearly visible, even to the naked eye, which composition of metals is best at absorbing hydrogen.

Gremaud is the first to use this method for measuring hydrogen absorption. The British company Ilika in Southampton wants to build a hydrogen analyser using this technique.

Source: Netherlands Organization for Scientific Research