German Aerospace Center

Safe and efficient – DLR develops innovative hydrogen tank for vehicles

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DLR has joined with partners in an EU research project to develop a 'combined tank' suitable for holding hydrogen in a compact space under moderate pressure and at ambient temperature. Coupled to a fuel cell, this tank was fitted into a vehicle for the first time as an integrated system and is able to supply electrical energy for air conditioning, auxiliary heating and lighting. Meeting for a workshop involving two other European ventures, the partners in the EU project came together in Turin on 25 and 26 June 2014 to exchange information on their research.

The storage material absorbs hydrogen like a sponge

The modular hydrogen tank consists of individual tubes placed side by side. They are filled with two different solids – black metallic alloys, whose consistency is comparable to that of flour. These storage materials absorb the gaseous hydrogen like a sponge to which it is then bound. This property enables storage of the gas in a small volume under a pressure of 70 bar and normal outside temperature, which is substantially better than a conventional tank that requires the hydrogen to be kept under a pressure of 700 bar. Inga Bürger, Project Manager at the DLR Institute of Engineering Thermodynamics mentions another advantage: "The use of solid materials in the tank means that hydrogen can be stored very safely; even if there is a leak, the strong bond between the gas and the storage materials ensures that hydrogen escapes at such a slow rate that there is no risk of explosion." The DLR researchers have succeeded in developing an innovative, combined tank equipped with new materials that exhibit a far greater storage capacity.

As part of the project, the researchers connected the tank with solid materials up to a high-temperature fuel cell for the first time, delivering electricity and the heat required to release the hydrogen from the storage materials. The entire system was fitted to an Iveco Daily van as an Auxiliary Power Unit (APU). Equipped with an additional fuelling port, the vehicle can be refuelled at a hydrogen filling station. The tank has a volume of 10 litres and offers a storage capacity of 1400 litres of hydrogen, sufficient to provide the van’s APU with one kilowatt of electrical energy for two hours.

The project

The University of Turin (UNITO, Italy) coordinated the EU research project SSH2S. EU-wide, it involved seven research centres and companies: DLR, Karlsruhe Institute of Technology (KIT), the Institute for Energy Technology (IFE, Norway), Tecnodelta s.r.l. (Italy), Serenergy A/S (Denmark), Fiat Research Centre (Italy) and Joint Research Centre of European Commission (JRC, Netherlands). KIT, IFE, JRC and UNITO lead the development of the storage materials. DLR cooperated with its partners, Technodelta and the Fiat Research Centre, to create the combined tank and the fuel cell coupling, and also their integration within the vehicle. The European Union provided €1.6 million in funding.

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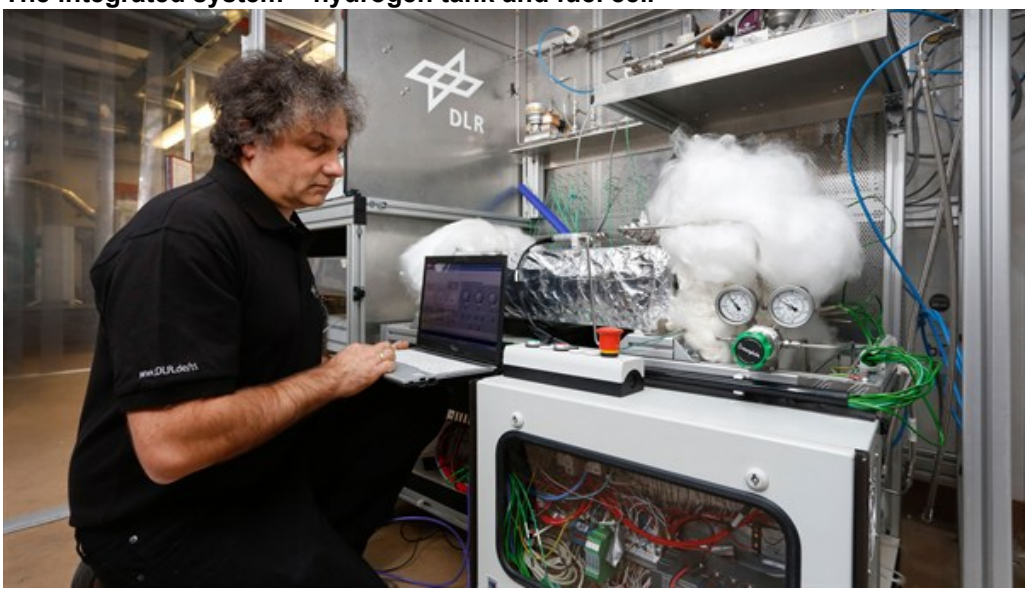
DLR is developing a hydrogen tank

The test facility for the hydrogen tank at the DLR Institute of Engineering Thermodynamics in Stuttgart.

Credit: DLR/Eppler.

The integrated system – hydrogen tank and fuel cell



The hydrogen tank is filled with solid materials that absorb the volatile gas like a sponge, allowing it to be stored at lower pressure and at ambient temperature.

Credit: DLR/Eppler.

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