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Hydrogen tank

A **Hydrogen tank** (other names- cartridge or canister) is used for hydrogen storage.[1][2][3] The first type IV hydrogen tanks for compressed hydrogen at 700 bars (70 MPa; 10,000 psi) were demonstrated in 2001, the first fuel cell vehicles on the road with type IV tanks are the Toyota FCHV, Mercedes-Benz F-Cell and the GM HydroGen4.

A Hydrogen tank on a Honda FCX platform

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Low-pressure tanks

Various applications have allowed the development of different H2 storage scenarios. Recently, the Hy-Can[4] consortium has introduced a small one liter, 10 bars (1.0 MPa; 150 psi) format. Horizon Fuel Cells is now selling a refillable 3 megapascals (30 bar; 440 psi) metal hydride form factor for consumer use called HydroStik.[5]

Type I

- Metal tank (steel/aluminum)
- Approximate maximum pressure, aluminum 175 bars (17.5 MPa; 2,540 psi), steel 200 bars (20 MPa; 2,900 psi).

Type II

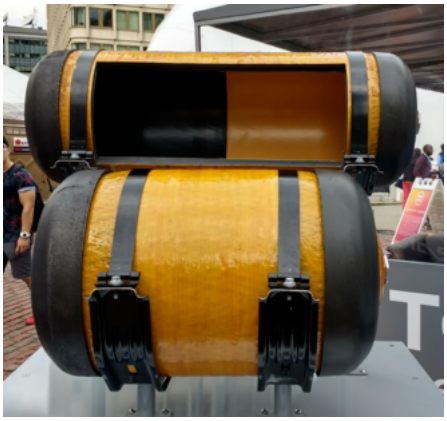
- Metal tank (aluminum) with filament windings like glass fiber/aramid or carbon fiber around the metal cylinder.[6] See composite overwrapped pressure vessel.
- Approximate maximum pressure, aluminum/glass 263 bars (26.3 MPa; 3,810 psi), steel/carbon or aramide 299 bars (29.9 MPa; 4,340 psi).

Type III

- Tanks made from composite material, fiberglass/aramid or carbon fiber with a metal liner (aluminum or steel). See metal matrix composite.
- Approximate maximum pressure, aluminum/glass 305 bars (30.5 MPa; 4,420 psi), aluminum/aramide 438 bars (43.8 MPa; 6,350 psi), aluminium/ carbon 700 bars (70 MPa; 10,000 psi).

Type IV

- Composite tanks such of carbon fiber with a polymer liner (thermoplastic). See rotational molding and fibre-reinforced plastic.
- Approximate maximum pressure 700 bars (70 MPa; 10,000 psi).[7]



Hydrogen tanks for the Toyota Mirai.

Type V

- All-composite, linerless Type V tank. CTD has built the first prototype tank for testing January 1, 2014.[8][9]

Tank testing and safety considerations

In accordance with ISO/TS 15869 (revised):

- Burst test: the pressure at which the tank bursts, typically more than 2x the working pressure.
- Proof pressure: the pressure at which the test will be executed, typically above the working pressure.
- Leak test or permeation test,[10] in NmL/hr/L (Normal liter of H2/time in hr/volume of the tank.
- Fatigue test, typically several thousand cycles of charging/emptying.
- Bonfire test where the tank is exposed to an open fire.
- Bullet test where live ammunition is fired at the tank.

Actual Standard EC 79/2009

- U.S Department of Energy maintains a hydrogen safety best practices site with a lot of information about tanks and piping.[11] They dryly observe "Hydrogen is a very small molecule with low viscosity, and therefore prone to leakage.".[12]

Metal hydride storage tank

Magnesium hydride

Using magnesium[13] for hydrogen storage, a safe but weighty reversible storage technology. Typically the pressure requirement are limited to 10 bars (1.0 MPa; 150 psi). The charging process generates heat whereas the discharge process will require some heat to release the H2 contained in the storage material. To activate those type of hydrides, at the

current state of development you need to reach approximately 300 °C (572 °F). [14] [15] [16]

Other hydrides

See also sodium aluminium hydride

Research

- 2008 - Japan, a clay-based film sandwiched between prepregs of CFRP.[17]

See also

- Cascade storage system
- Compressed hydrogen tube trailer
- Cryo-adsorption
- Gas cylinder
- Hydrogen compressor
- Hydrogen safety
- Hydrogen technologies
- Hydrogen economy
- Liquid hydrogen
- Liquid hydrogen tank truck
- Sodium aluminium hydride
- Magnesium hydride
- Pressure regulator

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External links

- Hydrogen Composite Tank Program (https://web.archive.org/web/20060926152646/http://www1.eere.energy.gov/hydrogenandfuelcells/pdfs/32405b27.pdf)
