



US Fuel Cell Council

Hydrogen: Basics



Hydrogen can link today's fossil-based energy supply with the renewable energy of tomorrow.

Hydrogen is the most abundant element in the universe and the lightest gas known. It is colorless, odorless, tasteless, and nontoxic at room temperature and pressure.

Hydrogen contains more useful energy per pound than any other fuel. This means hydrogen is more efficient on a weight basis than any of the fuels currently used in air or ground transportation. When hydrogen is used in a fuel cell, the only byproducts created are electricity, water and useful heat – no particulates, no carbon dioxide, and no smog.

Hydrogen Production and Distribution

On earth, hydrogen is found only in compounds with other elements. Almost all hydrogen in use today is made by separating, or "reforming," a hydrogen compound. Most hydrogen is produced from light hydrocarbons, such as natural gas, although in principle any hydrogen compound can be used – even plain water. Hydrogen is sometimes produced as a byproduct of other chemical processes.

A national hydrogen distribution network, or infrastructure, exists today to supply commercial users and demand is growing. Hydrogen is distributed by pipeline, truck, barge, and in smaller portable containers.

Hydrogen is a key component in the manufacture of many chemicals, especially ammonia and methanol. It is used in large quantities in refineries for manufacturing gasoline and heating oil. It is used to make fertilizers, glass, refined metals, vitamins, cosmetics, semiconductor circuits, soaps, lubricants, cleaners, margarine, peanut butter and rocket fuel. The National Aeronautic and Space Administration is the largest consumer of hydrogen in the world.



Hydrogen Storage

Hydrogen can be stored in many ways, but commonly it is compressed in steel or composite tanks and held at pressures up to 10,000 pounds per square inch (psi), or liquified at -423 degrees Fahrenheit. Liquefying is energy intensive, but liquid hydrogen has three times the amount of energy as an equal weight of gasoline.

Hydrogen can also be stored in metal hydrides – granular metal that absorbs hydrogen. These tanks are comparatively heavy. Similar, but lighter, are carbon nanotubes, and other carbon absorption techniques still in the experimental stage. Hydrogen can also be stored in chemical hydrides by way of chemical bonds. Chemical hydrides typically allow hydrogen to be stored in conventional tanks that only release hydrogen when a certain catalyst is present, making them very safe for transportation.



Hydrogen Safety

Like all good fuels, hydrogen contains a lot of energy. Hydrogen can be handled safely when guidelines for its safe storage, handling and use are observed. Hydrogen's combustion properties warrant the same caution required when using any fuel, as well as care to address the properties unique to hydrogen. Some of hydrogen's special properties actually may provide safety benefits compared to gasoline or other fuels. The hydrogen industry makes, distributes, stores and handles hydrogen nationwide and has compiled an exemplary safety record.

The Hindenburg Myth

People still associate hydrogen safety with the terrible crash of the Hindenburg more than 65 years ago. Yet the catastrophic fire aboard the Hindenburg was the result of the aluminum based material used on the dirigible's skin – a material akin to solid rocket fuel! Today's safety regulations do not permit this to occur. It should be noted that because hydrogen dissipates quickly, no Hindenburg fatality was the result of a burn from hydrogen.

Hydrogen Cost

Hydrogen costs more than gasoline per gallon but it can be used more efficiently. The US Department of Energy is working to achieve \$3.00 per gallon of gasoline equivalent at the station by 2008 and \$1.50 per gallon of gasoline equivalent (untaxed) at the station in 2010. Since fuel cell vehicles are two to three times more efficient, hydrogen may shortly cost less than gasoline for equivalent range.

For more information, visit our web site at www.usfcc.com.