

Hydrogen

Product Stewardship Summary

Chemical Information

Hydrogen was discovered in 1766 by Henry Cavendish and determined it produces water when burned. This is the property for which it was named, hydrogen means "water-former", by Antoine Lavoisier. Hydrogen was first produced in the 16th century by the reaction of acids with metals. Hydrogen is a colorless, odorless, non-toxic, flammable gas. It is the lightest and most abundant element in the universe. It is present as a gas in the earth's atmosphere at a concentration of only 1 part per million by volume. Hydrogen is the fuel burned and the primary component of our sun. Hydrogen is present in water and in the compounds of virtually all living things, but does not play an important role in biological pathways.

Hydrogen burns with an invisible flame and reacts readily with all oxidizers. It can be cryogenically liquefied and boils at atmospheric pressure at a temperature of -423 °F. Hydrogen can be produced by the electrolysis of water or reforming methane. Most hydrogen is commercially produced by steam-methane reforming, which heats methane and steam to create hydrogen and carbon monoxide.

Chemical Formula: H₂

Other Names: LH₂

Applications, Benefits, & Use

Chemicals: Hydrogen is used to make ammonia, which is commonly used as a fertilizer. It is also used to hydrogenate oils to make fats, like margarine.

Oil & Gas: Used extensively in the refining of oil to remove sulfur from fuels. It is also important at petrochemical plants in the hydrocracking and hydrodealkylation of large molecules.

Electronics: Hydrogen can be used as a reducing agent for many metal oxides. It is also used to saturate the bonds in amorphous silicon and carbon. It is commonly used as the purge gas for a variety of semiconductor operations due to its availability in very high purities

Fuel: Many feel hydrogen will be the fuel of the future, because it creates only water when it is oxidized. Fuel cells utilizing hydrogen are becoming increasingly popular in buses and cars.

Aeronautics & Space: Liquid hydrogen is used as a propellant for rocket launches.

Power Generation: Hydrogen is commonly used as the rotor coolant in the generation of electricity due to its high thermal conductivity and low density and viscosity

Glass Making: Hydrogen is used as a protective atmosphere in manufacture of glass sheets.

Laboratory: Hydrogen is a fuel and carrier gas for some analytical instruments.

Regulatory Information

There are regulations that govern the manufacture, sales, transportation, use and/or disposal of hydrogen. These regulations vary by city, state, country or geographic region. Additional regulatory information may be found on the Safety Data Sheet for hydrogen as well as local and federal agency websites.

Human Health and Environmental Effects

Human Health:

- Hydrogen is a simple asphyxiant and can displace oxygen to produce an unsafe breathing atmosphere. Hydrogen is nontoxic.
- Liquid hydrogen can result in severe frostbite, skin burns, and other tissue damage when in contact with skin or other tissues.
- Liquid hydrogen can condense and liquefy air creating additional cryogenic hazards or oxygen enriched atmospheres.

Environment:

- Manufactured hydrogen is not a persistent, bioaccumulative, or toxic substance therefore it does not have adverse effects on the environment.
- The concentration of hydrogen gas in the atmosphere is very low because its light weight enables it to escape earth's gravity.

Exposure Potential and Risk Mitigation Measures

Industrial Use:

- Hydrogen is shipped as a high pressure gas or supercooled liquid. Precautions should be taken based on shipment mechanism (pipeline, bulk transport trucks, gas cylinders, etc.).
- Use flammable gas detection to ensure hydrogen levels do not increase to levels that create an explosion or fire hazard.
- Personnel should be trained on the hazards and risks of hydrogen and keep work areas clear of ignition sources.
- Electrical equipment and components used in hydrogen and flammable hydrogen mixtures must be properly designed for this service. Specialized electrical equipment is needed for hydrogen service.

Consumer Use:

- Hydrogen is transported by pipeline, so exposure to direct consumers is not anticipated.

Additional Sources of Information

- Air Liquide Gas Encyclopedia
- Air Liquide Safety Data Sheets
- American Chemistry Council
- Compressed Gas Association (CGA)

Contact Information

For matters related to health, safety, security, environment or Responsible Care® commitments, contact us by phone at 713-438-6721 or by [email](#).