

#Challenges in hydrogen storage system with working of Liquid storage system

Hydrogen has become an essential element for many different industries, including the automotive sector, which is new sustainable alternatives through zero-emissions vehicles

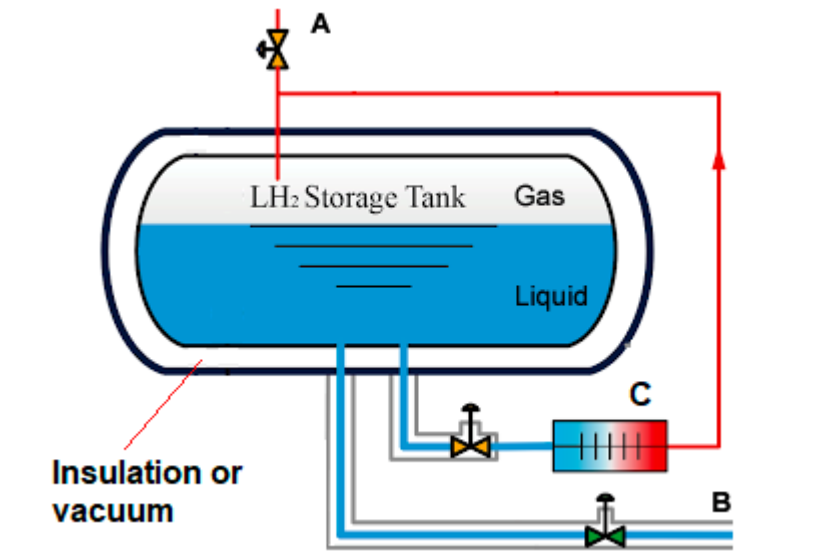
Hydrogen storage system.

Hydrogen storage is a technology for the advancement of hydrogen and fuel cell technologies in applications stationary power, portable power, and transportation.

Hydrogen has the highest energy per mass of any fuel

Its low ambient temperature density results in a low energy per unit volume, therefore requiring the development of advanced storage methods that have potential for higher energy density

Working Principle



A liquid hydrogen storage system works by storing hydrogen gas in its liquid state, which is achieved at extremely low temperatures.

Compression: Hydrogen gas is initially compressed to increase its density.

Cooling: The compressed hydrogen is then cooled to cryogenic temperatures (around -253°C or -423°F) using specialized equipment, such as heat exchangers or cryocoolers.

Storage: The cooled hydrogen gas is stored in a well-insulated container, typically a dewar or cryogenic tank, designed to maintain the low temperatures and minimize heat transfer.

Pressure Control: To maintain the hydrogen in its liquid state, pressure is carefully controlled, balancing between the need to keep it in liquid form and preventing excessive pressure buildup.

Safety Measures: Safety features, such as pressure relief valves and venting systems, are incorporated to ensure safe operation and prevent overpressure.

Withdrawal: When needed, the liquid hydrogen is withdrawn from the storage system and warmed to return it to its gaseous state. It can then be used for various applications, such as rocket propulsion, fuel cells, or industrial processes.

Overall, the key to the functioning of a liquid hydrogen storage system is the ability to maintain very low temperatures, which keeps the hydrogen in its dense liquid state, making it more practical for storage and transportation.

Challenges in hydrogen storage

compressed hydrogen gas storage has a low energy density, which makes it unsuitable for long-range transportation or large-scale energy storage applications. Additionally, the high-pressure tanks required for this method can be heavy and expensive, making it less practical for some applications

Applications

- Helps **storing energy** produced by renewables, which is often intermittent
- Works as **rocket fuel for combustion** in the space industry, including nuclear-powered rockets
- Provides **decarbonized alternatives** for domestic heating
- Plays a part in the **metallurgical industry**, where it prevents oxidation and reduces metal oxides

Raw material for chemical processes, including the manufacture of plastics (polyethylene and polypropylene)