Introduction to the flagship product, a large-capacity Hydrogen Generator and key achievements

Safe hydrogen storage in solid $NaBH_4$,

Simple and convenient hydrogen generation and supply system,

Carrying out projects at home and abroad

such as Armored Vehicle, Wearable skeleton suit, Robots, Power Generators, etc.

May, 2024

Hugreen Power Inc.

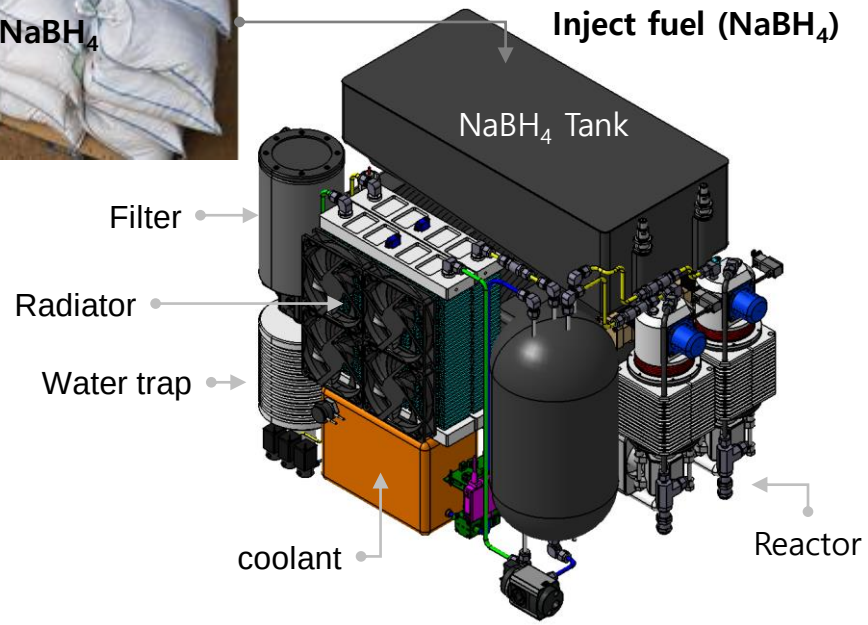
Gwangju, Korea since 2011

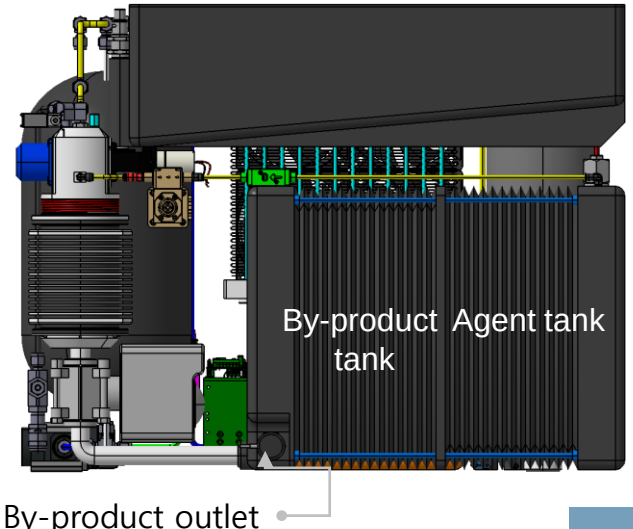
Large-capacity Hydrogen Generator(Flagship Product)

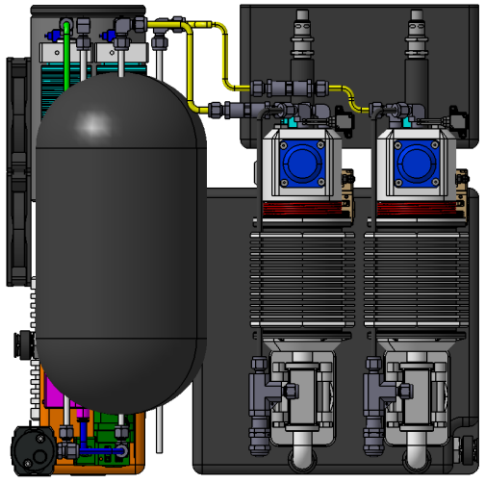
- Hydrogen Generator that can generate and supply hydrogen up to 1,000 LPM.
- Safe hydrogen storage in solid ($NaBH_4$) form.
- Inject fuel and remove by-products by hand without any tools.
- Modular system configuration provides flexibility when integrating a hydrogen generator and a fuel cell.　※ Enables efficient system configuration.
- Can be used as a mobile hydrogen charging station.

Solid form H_2 Storage and Generation Technology

- Hydrogen is stored in a separate fuel tank in the form of solid $NaBH_4$
  ☞ Hydrogen generation / supply by transferring solid $NaBH_4$ to the reactor.
- Solid form ($NaBH_4$) H_2 storage in fertilizer bags, etc. (quick refueling)
  ※ Differentiating safety from existing hydrogen storage methods (Compressed hydrogen, etc.) in terms of storage.
- Refueling by hand without a separate tool ☞ Easy and convenient to use.







Introduction to key achievements

Summary of Key Achievements

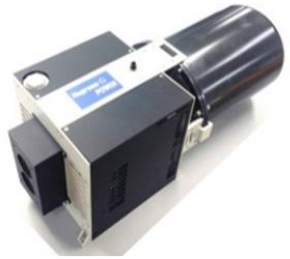
- Hydrogen Generator for Fuel-Cell-Powered High Altitude UAV (Boeing, U.S, 2014~2017)
- Auxiliary Fuel Cell System for the military electric vehicles for NATO (IMPACT, Poland, 2014)
- Korean Army Defence Project, ‘Next Generation Power Development for Wearable Skeleton suit (2017~2020)
- Fuel-cell-powered ‘Wheeled Armored Vehicle’ project (Hyundai Motor company, 2022~)
- Rheinmetall (Germany, 2021), Toyota (Japan, 2022), etc.
- Power Generator project for the Korean military (Hanwha Aerospace, 2023~)

Hydrogen Generator for High Altitude UAV

Korean Army Defense Project

Fuel Cell APU for NATO

Portable Powerpack

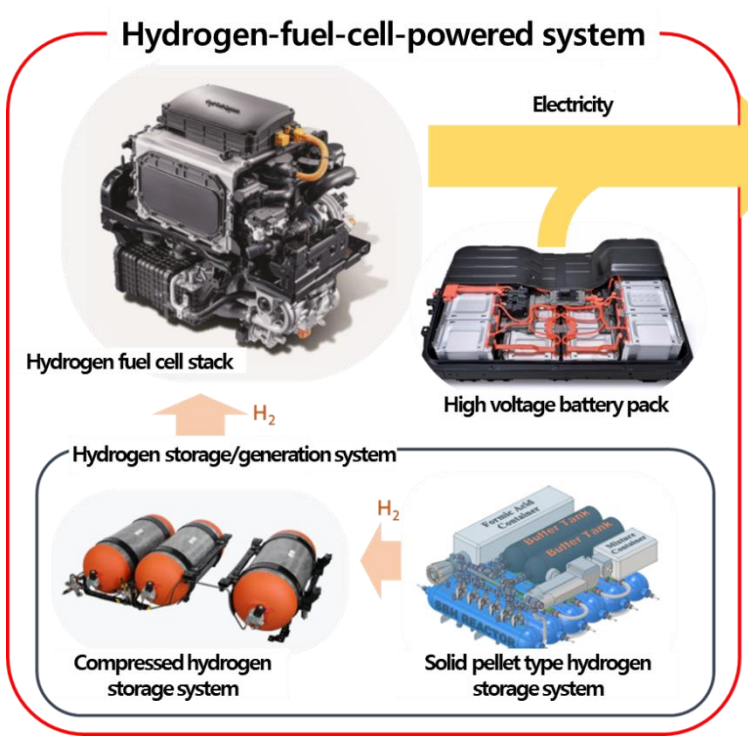


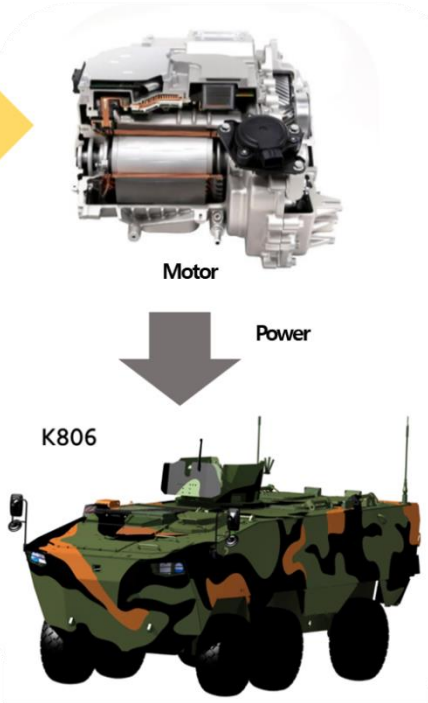
Hydrogen Generator for High Endurance UAV

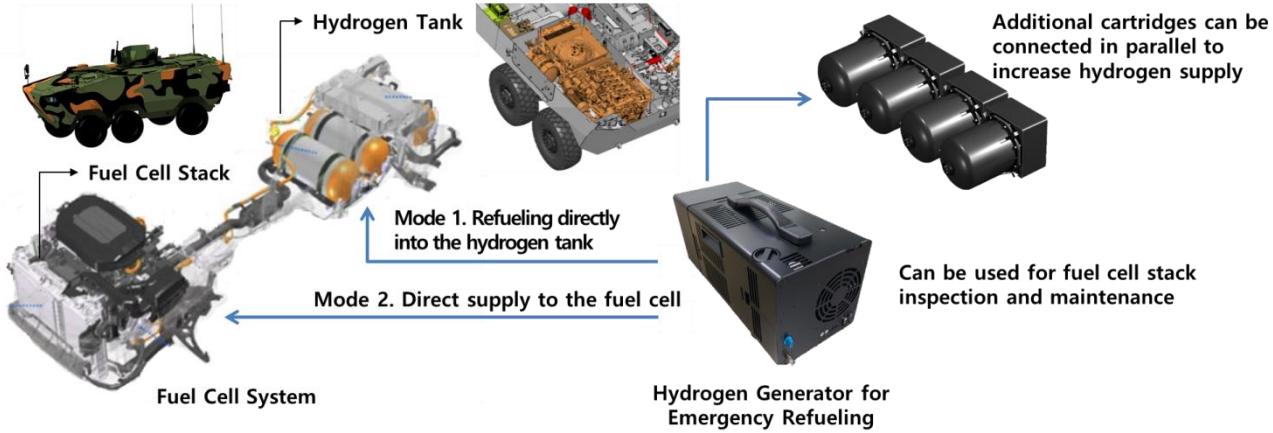
Large capacity Hydrogen Generator

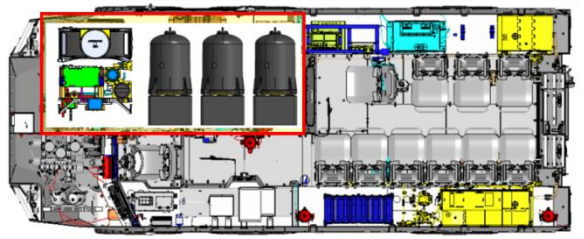
Wheeled Armored Vehicle Project (Hyundai Motor Group; 2022~)

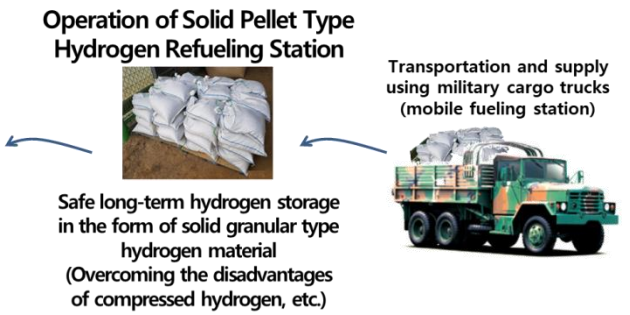
- Development of 250kW military wheeled armored vehicle using hydrogen fuel cell to secure decarbonization, maneuverability, and low detectability
- Development of a hybrid hydrogen storage system linking hydrogen generator and compressed hydrogen to secure optimal hydrogen storage and respond to emergency situations











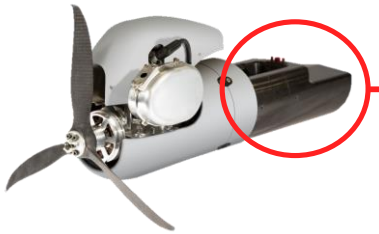
Low capacity Hydrogen Generator

Military UAV project (Boeing, US; 2014~2017)

- Hydrogen Generator for Fuel-Cell-powered High Altitude UAV

Scan Eagle

Replacing the existing engine with a fuel cell system



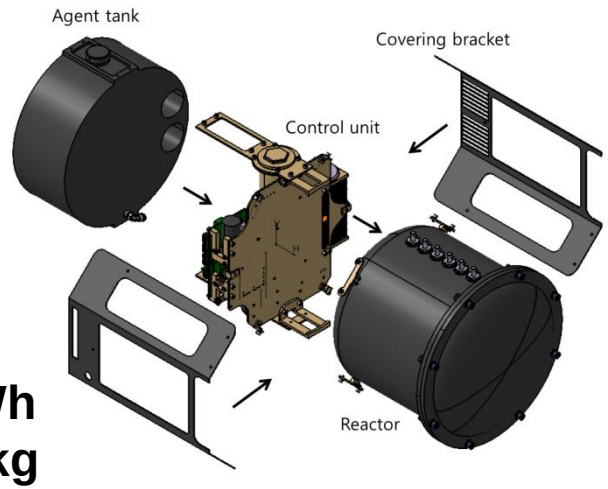
Fuselage-shaped Hydrogen generator

8 hour Endurance

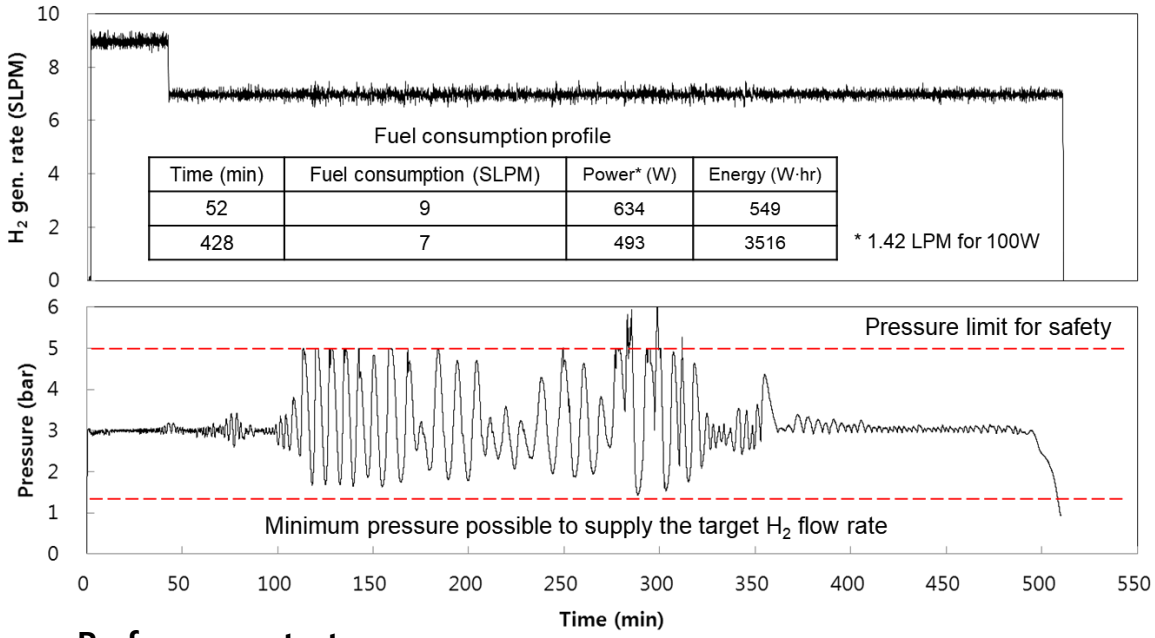
-40°C ~ +60°C Operable

Energy Capacity: 4,000 Wh

Energy Density: 670 Wh/kg



Configuration of hydrogen generator



Time (min)	Fuel consumption (SLPM)	Power* (W)	Energy (W·hr)
52	9	634	549
428	7	493	3516

* 1.42 LPM for 100W

Performance test

Wearable Exoskeleton suit project for the Korean Military (2017~2020)

Hugreen POWER

■ Hydrogen Generator for the Korean Military Exoskeleton suit

24 hour Operation

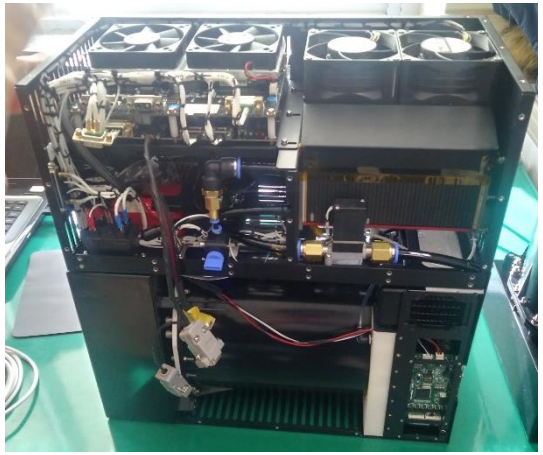
0 ~ +40°C Temperature test required and passed

Energy Capacity: 4,680 Wh

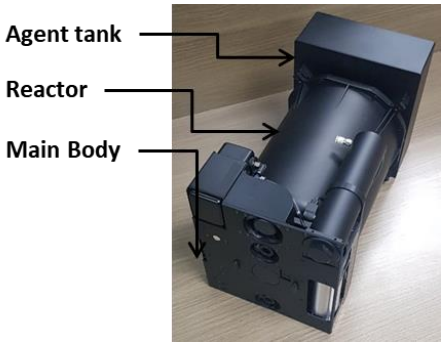
Energy Density: 680 Wh/kg

Fuel Cell Stack

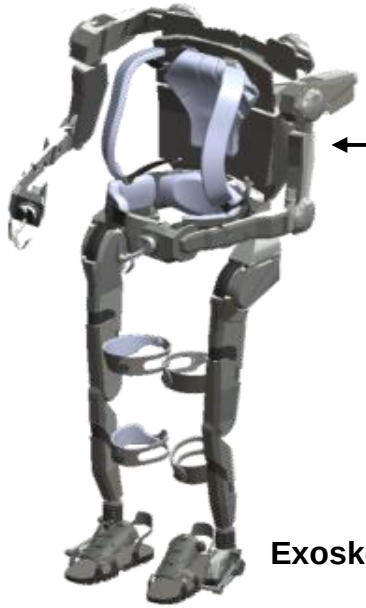
- Air-cooled PEMFC stack
- Electricity generation from H_2/Air
- Battery recharging & Power supply



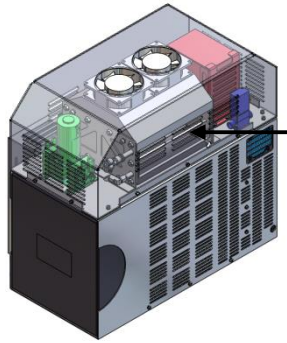
Next-generation energy source



Hydrogen generator



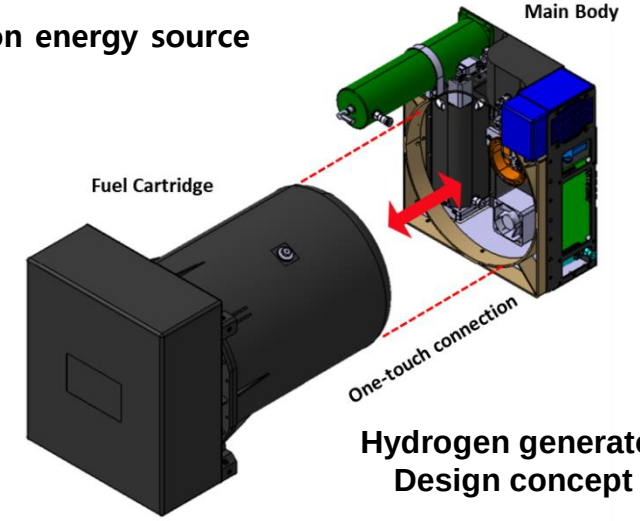
Exoskeleton suit



Next-generation energy source

Hydrogen Generator

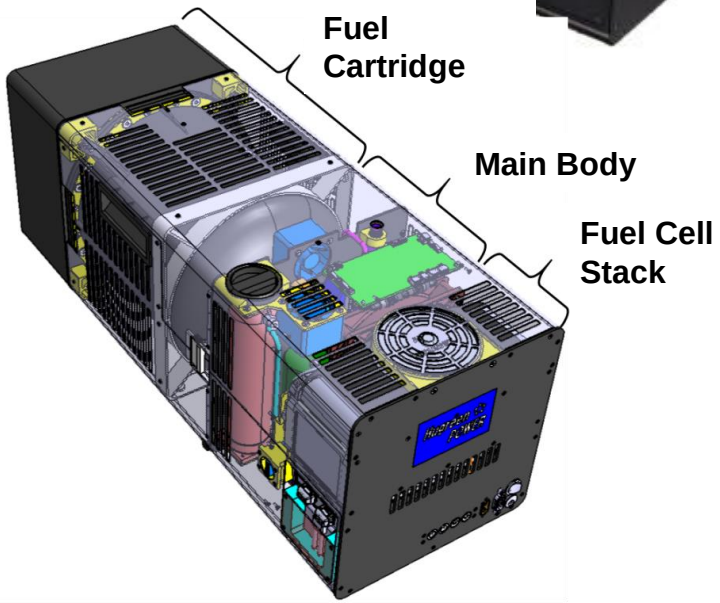
- H_2 generation from solid $NaBH_4$
- Low power consumption and High efficiency hydrogen supply



Hydrogen generator Design concept

Power Generator Project (Rheinmetall, Germany; 2021)

HP-3000FCS



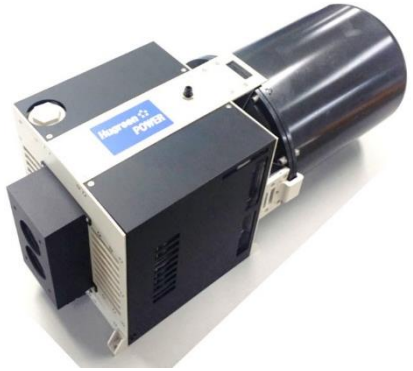
Specifications

Fuel cell system	Maximum continuous power	200 W
	Maximum peak power (limited to)	300 W
	Output voltage	20 ~ 25 V
	Dimensions	200 X 200 X 570 mm
	Weight (including fuel cartridge)	9,000 g
Fuel cartridge	Dimensions	200 X 200 X 367 mm
	Weight	5,200 g
	Relief valve set pressure	2.5 bar
	Maximum endurable pressure	3.0 bar
Hybrid battery	Dimensions	45 X 35 X 70 mm
	Weight	200 g
	Capacity	1,300 mAh
	Emergency operation time	2 minutes
Safety features	Operating conditions	5 ~ 35°C
	Storage temperature	0 ~ 40°C
	System lifetime	500 hours
Other features	Communication	RS232
	Output electrical connector	XT-60

Other Developments

- Auxiliary Fuel-Cell Power Generator (200W Fuel Cell) for Relief Electric Vehicles for NATO(2014)

- Hydrogen Generator (500W Fuel Cell) for High-Endurance UAV for KIER (Korea Institute of Energy Research, 2017)

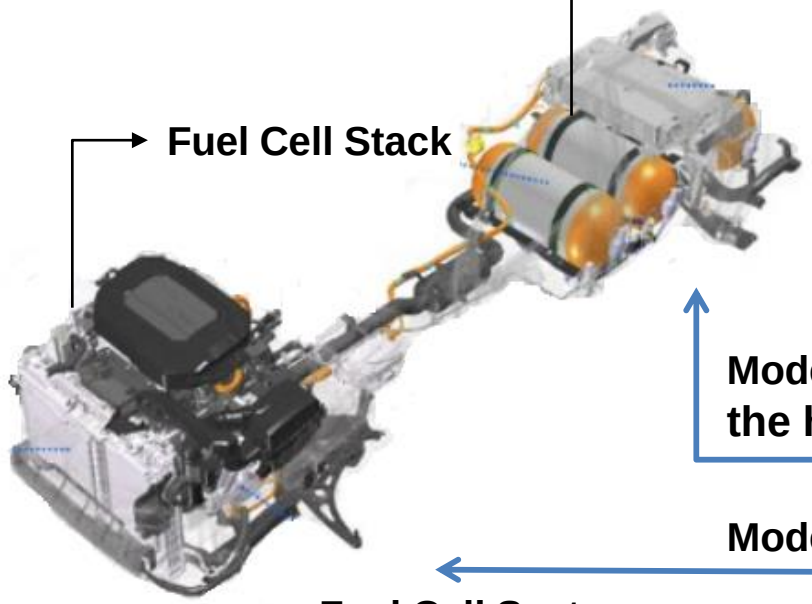


- Household generator and hydrogen cartridge for Toyota, Japan(2022)

Future Projects

Hydrogen Generator for Emergency Refueling of Trucks

- Option 1: If emergency hydrogen refueling is required, it can be refueled directly into the existing hydrogen tank and moved to a hydrogen charging station.
- Option 2: Direct fueling to the fuel cell enables emergency power generation, battery charging, and operation of basic electrical components
- Stable fuel storage for a long time and constant hydrogen generation / supply are possible



Mode 1. Refueling directly into the hydrogen tank

Mode 2. Direct supply to fuel cell

Hydrogen Generator (Example)

Possible to expand hydrogen supply through parallel connection of cartridges

Can be used for fuel cell stack inspection and maintenance

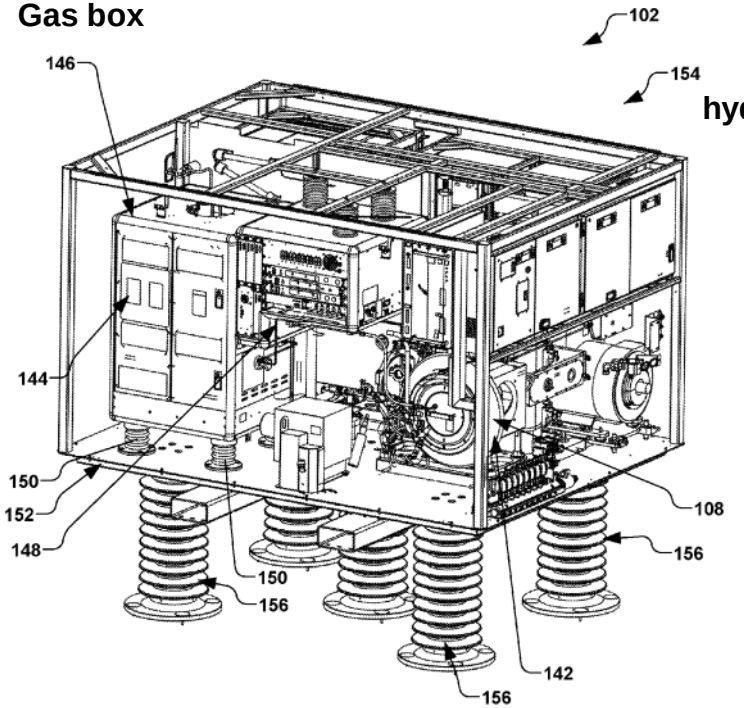
Hydrogen Generator for Semiconductor Equipment (Samsung Electronics)

- Current Situation: Hydrogen charging station - complex hydrogen supply line - supplying hydrogen to semiconductor equipment through the hydrogen storage tank

  ※ A safety manager is necessary because of the danger

- When using our hydrogen generator, only the hydrogen generator needs to be installed in the equipment, and one fuel cartridge can be used for about 5 months. → Overall costs such as hydrogen supply construction cost and operating cost can be greatly reduced

Gas box

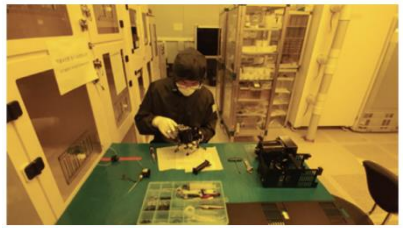


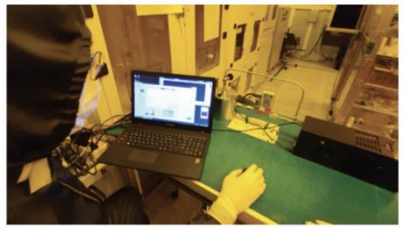
Ion implanter with hydrogen tank

hydrogen tank for Ion Implanter

Replace

Hydrogen generator
for semiconductor equipment





Hydrogen generator production process in clean room

Possible to operate a field hydrogen supply station

- Simple installation and operation of supply stations anywhere in the field
- No need for a hydrogen refueling station, suitable for field operations and advantageous for maneuvering in wartime
- The only alternative to overcome the restrictions on operation of hydrogen refueling stations in wartime
- In addition to military trucks, transportation by individual soldiers is possible

Mobile hydrogen refueling station

Fuel change available at any time

Loading and transportation using military trucks

Operation of Field Hydrogen Supply Stations

Mobile Supply Station

Solid $NaBH_4$ form H_2 can be safely stored for a long time

Easy and quick fuel change

Military Command Post

Military vehicle type Fuel Cell powered Generator

Thank you!

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