

Name of the product	GERMANIUM TETRAHYDRIDE (10%)
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1. Chemical product and corporate information.

- A. Name of the product 10% GERMANIUM TETRAHYDRIDE(GERMANE)
- B. Recommended use of the product and limitation of the usage.  
 Recommended use of the product Semiconductor Gas.  
 Limitation of the usage: No data available.
- C. Supplier's information.(In case of imported product, state the supplier's information for emergency contact)  
 Name of the corporate: FEWM Co. LTD  
 Address: 53, Jeungpyeong2sandan-ro, Doan-  
 myeon, Jeungpyeong-gun,  
 Chungcheongbuk-do  
 Emergency Contact: 043-838-9562

2. Hazards. Maleficence

- A. Hazards. Maleficence classification Inflammability category: H241  
 Toxicity: No data available  
 Carcinogenicity: No data available

B. Cautionary statements including the measures for safety.  
 Symbolics



Signals	Hazards
Hazards wordings	Inflammable gas
Preventional wordings	No data available.

C. Other hazards and maleficence not included in the standards of the category of hazards and maleficence (NFPA)

Sanitation	1
Fire	4

## 3. Title and content of the component

Name of the Component	Nickname (Trivial name)	CAS no	Content (%)
Hydrogen	HYDROGEN GAS	1333-74-0	90
Germanium tetrahydride (GeH <sub>4</sub> )	Germane GeH <sub>4</sub>	7782-65-2	10

## 4. Emergency measures.

## A. If in eyes

It must be washed with clean water until the professional medical specialist reaches, and it must be washed for more than 16 minutes. Until the patient reaches the ophthalmologist or advised by the emergency assistant, continue washing.

## B. If on skin

It must be washed with clean water until the professional medical specialist reaches, and it must be washed for more than 16 minutes. The clothing must be washed clean with a sterile pad and if the patient (sentence discontinued) on the neck, face, head or  
Medical attention from a doctor is required.

## C. If inhaled

If burnt on the chest, inhalation is the major route of exposure.

Seclude the person who has inhaled the as or from the contaminated area.

If the person who has inhaled is not able to breathe independently, the maintainer must rescue for the breathing.

If the pulse of the person who has inhaled does not beat, CPR must be done.

If there is a person trained and medical oxygen, 100% oxygen must be enforced to the inhaled person.

The emergency ambulance must be called. If the ambulance could not be used, to follow the policy, contact doctor, hospital or specific control center.

While waiting for professional medical personnel, maintain the patient to rest comfortably and keep warm and watch the breathing the pulse regularly. If required, CPR and artificial respiration must be done.

## D. If swallowed.

It cannot be swallowed as it is in gaseous form.

## E. Major symptoms/result, acute and chronic

No data available.

## F. Other cautions to doctor

The result of the exposure to germanium tetrahydride is considered similar to hydride cythemolysis. Diuresis, hemodialysis, and transfusion must be considered.

## 5. Measures in case of explosion, fire.

### A. Recommended (prohibited) extinguisher.

Recommended extinguisher	Water spray or foam extinguisher
Prohibited extinguisher	No data available.
Big fire	No data available.

### B. Specific hazard from the chemical component

Toxicity from combustion	Toxic and harmful vapor may be formed by thermal decomposition.
Risk of fire and explosion	Risk of fire or explosion by combustion.

### C. Protective equipment when fire-fighting and preventional measures.

Positive pressure breathing equipment and protective (Sentence discontinued)

Extinguishment method is to prevent the vaporization of the flammable liquid, and if not possible, the burning of the cylinder must be prevented.

## 6. Measures in case spillage

### A. Required measures and protections to protect the body.

Eliminate all the sources of ignition.  
Quarantine the location until the gas disposes of.  
Prohibit smoking, fire, flare in the location of the fire.  
Prohibit access other than the staff.  
Quarantine the area of danger and control the access.  
Ventilate the confined area before access.  
Evacuate the dangerous area due to gas.

### B. Environmental measures.

Do not wash it to the drainage.  
In case of a large amount of spillage, report 911, Ministry of environment, Regional Environmental Management Office, municipal, provincial (Environmental inspection office)

In case the spillage could be stopped safely, stop the spillage.  
Make use of water spray to reduce the vapor.

## 7. Handling and storage measures.

### A. Safety measures.

Liquid Germanium tetrahydride could deflagrate without oxygen (By decomposition of hydrogen and germanium tetrahydride) or any specific source of energy. Cooling it condenses the germanium tetrahydride, hence do not cool the germanium tetrahydride below the room temperature.

Treat germanium tetrahydride that is sealed and purged only. Design of the system of the dangerous material should consider the confined bellows, backfire protector and flow meter and restrictor as per the content of MSDS.

Some material could be concentrated behind the exit. Appropriate protection must be worn.

No material could be incused in the gas cylinder, and if the cylinder is thought to be contaminated, immediately inform FEWM. Maximum information on the contamination and characteristic must be informed.

B. Safe storage measures.

It must be stored as per the regulations of handling the high-pressure gas, architectural law, firefighting code, and other regulations.

Materials must be secluded by danger.

## 8. Prevention of spillage and personal protection.

A. Exposure standards of the chemical material, biological exposure standards.

KOSHA TWA: 0.2ppm. 0.6mg/m<sup>3</sup>

ACGIH Regulation TWA-TLV 0.2ppm

Biological exposure standards No data available.

B. Appropriate engineering maintenance.

Regional drainage is required. Gas disposal appropriate for secondary pollution is strongly recommended.

The site of processing and the secondary polluted area must be watched regularly for the exposure of the material.

A personal automatic warning system and the auto stoppage of flux must be appropriately applied.

All the major pollution systems must be purged to non-reactivity gaseous nitrogen before infusing the germanium tetrahydride.

C. Personal protection

Respiratory protection If spillage is suspected, positive pressure breathing apparatus, full face mask, oxygen providing facility must be used in the site of the procedure.

Eye protection For the emergency case, the air providing apparatus is required. To prevent the splash while using call out protection, the face mask must be used, and safety glass must be used while the cylinder is moving.

Hand protection Safety shoes and safety glove must be worn while moving the cylinder.

Body protection Wear protective clothing. Avoid repeated or prolonged skin contact to the liquid and vapor. Use the items that have completed the inspection by the Korea Occupational Safety and Health Agency. (Inside Zamark) (Limited to flame resistant clothing)

## 9. Physicochemical characteristic.

- A. External  
Shape No color  
Color No color
- B. Odor  
Germanium tetrahydride - pungent smell (stinging). Hydrogen - Odorless
- C. Odor threshold  
No data available.
- D. pH  
Not applicable.
- E. Melting point/ freezing point  
Germanium tetrahydride: -165.9 C (-266.7 F). Hydrogen: No data
- F. Initial boiling point and boiling point range  
Germanium tetrahydride: -88.4 C (-127.0 F).. Hydrogen: -252.9C (-424F)
- G. Ignition point  
No data available.
- H. Vaporization speed  
No data available.
- I. Inflammability (solid, vapor)  
No data available.
- J. Upper limit or lower limit of the range of ignition or explosion  
No data available.
- K. Steam pressure  
Germanium tetrahydride:45 bar (22C). Hydrogen:No data
- L. Solubility  
Germanium tetrahydride: Splenolysis. Hydrogen: 0.0183
- M. Vapor density  
Germanium tetrahydride:3.42g/l at 0 C. Hydrogen: 0.083 g/l
- N. Specific gravity  
Germanium tetrahydride:1.523 (-143 C). Hydrogen: No data.
- O. n-octanol-water partition coefficient  
No data available.
- P. Auto-ignition temperature  
No data available.
- Q. Decomposition temperature  
No data available.
- R. Viscosity  
No data available.
- S. Molecular weight  
Germanium tetrahydride:76.6662. Hydrogen: 2.03

## 10. Stability and reactivity

A. Chemical stability and hazardous reactivity

The germanium tetrahydride is safe in room temperature and in air, but it is not safe when it is decomposed to germane and hydrogen by a sudden increase of temperature and pressure. The liquid form of germanium tetrahydride could deflagrate in air and without any specific source of energy.

B. Possibility of adverse reaction while in reaction.

No data available.

C. Conditions to avoid

Above 51 C or exposure to the source of ignition, air.

D. Materials to avoid

Oxygen, Halogen.

E. Harmful decomposed product

Germanium oxide, hydrogen.

## 11. Toxicological information.

A. Information on routes of exposure of high possibility.

Inhalation	Harmful when inhaled.
Ingestion	No data available.
Skin contact	No data available.
Eye contact	No data available.

B. Health hazards information.

Oral	No data available.
Skin	No data available.
Inhalation	No data available.
(Pure germanium tetrahydride: Gaseous material LC50-622ppm/2hour)	
Skin corrosion or irritation	No data available.
Serious eye damage or irritation	No data available.
Respiratory sensitization	No data available.
Skin sensitizations	No data available.
Carcinogenicity	No data available.
Germ-cell mutagenicity	No data available.
Reproductive toxicity	No data available.
Specific target organ systemic toxicity (Single exposure)	No data available.
Specific target organ systemic toxicity (Repeated exposure)	No data available.
Aspirations respiratory tract hazards	No data available.

C. Toxicity value No data available.

## 12. Effects on the environment.

A. Ecotoxicity

Fish No data available.  
Crustacean No data available.  
Algae No data available.

B. Persistent and biodegradable.

Persistent No data available.  
Degradability No data available.

C. Bio-accumulative potential

Condenasability No data available.  
Biodegradability No data available.

D. Mobility in soil

No data available

E. Other adverse effects

No data available

### 13. Disposal considerations.

A. Methods of waste disposal

Before released to the atmosphere, it should be released appropriately or after the procedure.

B. Cautious measures when disposal.

The licensee that releases the industrial waste (Waste management ledger) must dispose the wastes occurred in the industrial site, or dispose of it via the processors of waste, person recycles the waste of others, the person who installs, operates the waste disposal facility. The empty container should not be disposed illegally.

### 14. Information required for the transport.

A. UN No.

UN1954: High pressure gas, combustibility. NOS:2.1

B. Proper shipping name:

Germanium tetrahydride

C. Transportation hazard classification

No data available.

D. If applied, the packing group

No data available.

E. Marin pollution (Marine pollutant material)

No data available.

F. Special transport measures to the transport or the transportation and precautionary conditions that the user should know.

Emergency measures in case of fire

No data available.

Emergency measures in case of spillage  
No data available.

#### 15. Legal regulatory status.

- A. Regulations by occupation safety and health acts  
The object of the establishment of exposure standard material
- B. Regulations by Chemicals control Act  
The material to prepare for the accident.
- C. Regulations by Safety Control of Dangerous Substances  
No data available
- D. Regulations by waste control act  
No data available.
- E. Regulations by domestic and foreign law.  
40CPR302.40  
CERCLA Reportable Quantity  
302 Sector  
(40CFR372)  
SARA tile III status  
313 Sector  
(40CFR372)

#### 16. Other information.

- A. Source of reference.  
Book of SEMI Standards, Facilities Standards and Safety Guidelines, Mountain View, CA: Semiconductor Equipment and materials International, 1994. Safe Handling of Compressed Gases in Containers (Pamphlet P-1), Arlington, VA: Compressed Gas Association, Inc., 1991. Fire Protection Guide on Hazardous Materials. Quincy, MA: National Fire Protection Association, 1991. Borak, Jonathan, M.D., Michael Callan, and William Abbott, Hazardous Materials exposure Emergency Response and Patient Card. Englewood Cliffs, NJ: Prentice-Hall, Inc., 1001, Effects of Exposure to Toxic GasesL First Aid and Treatment. Lyndhurst, NJ: Matheson Gas Products, 1997. Documentation of TLC's and BEI's. Cincinnati, Ohio; American Conference of Government Industrial Hygienists, 1992.
- B. Initial date of preparation 1st May 2012
- C. Number of revision and first date of issue  
Number of revision 4 times  
Last date of revision 9th August 2018
- D. Miscellaneous

The issued Material safety data sheet (MSDA) is document edited and amended by referencing the MSDS provided by Air Liquide advanced materials Company.