

Germanium

sc-250052



The Power to Question

Material Safety Data Sheet

Hazard Alert Code
Key:

EXTREME

HIGH

MODERATE

LOW

Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME

Germanium

STATEMENT OF HAZARDOUS NATURE

CONSIDERED A HAZARDOUS SUBSTANCE ACCORDING TO OSHA 29 CFR 1910.1200.

NFPA



SUPPLIER

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EMERGENCY

ChemWatch

Within the US & Canada: 877-715-9305

Outside the US & Canada: +800 2436 2255

(1-800-CHEMCALL) or call +613 9573 3112

SYNONYMS

Ge, ekasilicon

Section 2 - HAZARDS IDENTIFICATION

CHEMWATCH HAZARD RATINGS

	Min	Max
Flammability	3	
Toxicity	2	
Body Contact	2	
Reactivity	2	
Chronic	2	

Min/Nil=0
Low=1
Moderate=2
High=3
Extreme=4



CANADIAN WHMIS SYMBOLS



EMERGENCY OVERVIEW

RISK

Highly flammable.

POTENTIAL HEALTH EFFECTS

ACUTE HEALTH EFFECTS

SWALLOWED

- Accidental ingestion of the material may be damaging to the health of the individual.
- Germanium exposure at high levels leads to dehydration, fall in blood pressure and severe drop in core body temperature.

EYE

- There is some evidence to suggest that this material can cause eye irritation and damage in some persons.
- Contact with the eye by metal dusts may cause mechanical abrasion or foreign body penetration of the eyeball.

SKIN

- The material is not thought to produce adverse health effects or skin irritation following contact (as classified by EC Directives using animal models).

Nevertheless, good hygiene practice requires that exposure be kept to a minimum and that suitable gloves be used in an occupational setting.

- Open cuts, abraded or irritated skin should not be exposed to this material.
- Entry into the blood-stream, through, for example, cuts, abrasions or lesions, may produce systemic injury with harmful effects. Examine the skin prior to the use of the material and ensure that any external damage is suitably protected.

INHALED

- The material is not thought to produce respiratory irritation (as classified by EC Directives using animal models). Nevertheless inhalation of dusts, or fumes, especially for prolonged periods, may produce respiratory discomfort and occasionally, distress.

- Inhalation of dusts, generated by the material during the course of normal handling, may be damaging to the health of the individual.
- When inhaled, there is most likely a moderately fast elimination from the lungs with 52% disappearing within 1 day and 82 % in 7 days.
- Persons with impaired respiratory function, airway diseases and conditions such as emphysema or chronic bronchitis, may incur further disability if excessive concentrations of particulate are inhaled.

If prior damage to the circulatory or nervous systems has occurred or if kidney damage has been sustained, proper screenings should be conducted on individuals who may be exposed to further risk if handling and use of the material result in excessive exposures.

- The inhalation of small particles of metal oxide results in sudden thirst, a sweet, metallic foul taste, throat irritation, cough, dry mucous membranes, tiredness and general unwellness.

Headache, nausea and vomiting, fever or chills, restlessness, sweating, diarrhoea, excessive urination and prostration may also occur.

CHRONIC HEALTH EFFECTS

- Substance accumulation, in the human body, may occur and may cause some concern following repeated or long-term occupational exposure.

Metallic dusts generated by the industrial process give rise to a number of potential health problems. The larger particles, above 5 micron, are nose and throat irritants. Smaller particles however, may cause lung deterioration. Particles of less than 1.5 micron can be trapped in the lungs and, dependent on the nature of the particle, may give rise to further serious health consequences.

Inhalation of the dusts of metallic germanium and germanium dioxide causes thickening of lung tissue and associated blood vessels.

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

NAME	CAS RN	%
germanium	7440-56-4	>98

Section 4 - FIRST AID MEASURES

SWALLOWED

- If swallowed do NOT induce vomiting.
- If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration.
- Observe the patient carefully.
- Never give liquid to a person showing signs of being sleepy or with reduced awareness; i.e. becoming unconscious.

EYE

If this product comes in contact with the eyes

- Wash out immediately with fresh running water.
- Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids.
- Seek medical attention without delay; if pain persists or recurs seek medical attention.
- Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.
- DO NOT attempt to remove particles attached to or embedded in eye .
- Lay victim down, on stretcher if available and pad BOTH eyes, make sure dressing does not press on the injured eye by placing thick pads under dressing, above and below the eye.
- Seek urgent medical assistance, or transport to hospital.

SKIN

If skin or hair contact occurs

- Flush skin and hair with running water (and soap if available).
- Seek medical attention in event of irritation.

INHALED

- If fumes or combustion products are inhaled remove from contaminated area.
- Lay patient down. Keep warm and rested.
- Prostheses such as false teeth, which may block airway, should be removed, where possible, prior to initiating first aid procedures.
- Apply artificial respiration if not breathing, preferably with a demand valve resuscitator, bag-valve mask device, or pocket mask as trained. Perform CPR if necessary.

NOTES TO PHYSICIAN

- Copper, magnesium, aluminium, antimony, iron, manganese, nickel, zinc (and their compounds) in welding, brazing, galvanising or smelting operations all give rise to thermally produced particulates of smaller dimension than may be produced if the metals are divided mechanically. Where insufficient ventilation or respiratory protection is available these particulates may produce "metal fume fever" in workers from an acute or long term exposure.
- Onset occurs in 4-6 hours generally on the evening following exposure. Tolerance develops in workers but may be lost over the weekend. (Monday Morning Fever)
- Pulmonary function tests may indicate reduced lung volumes, small airway obstruction and decreased carbon monoxide diffusing capacity but these abnormalities resolve after several months.

Section 5 - FIRE FIGHTING MEASURES

Vapor Pressure (mmHG)	Not applicable
Upper Explosive Limit (%)	Not applicable
Specific Gravity (water=1)	5.323
Lower Explosive Limit (%)	Not applicable

EXTINGUISHING MEDIA

Metal dust fires need to be smothered with sand, inert dry powders.

DO NOT USE WATER, CO2 or FOAM.

- Use DRY sand, graphite powder, dry sodium chloride based extinguishers, G-1 or Met L-X to smother fire.
- Confining or smothering material is preferable to applying water as chemical reaction may produce flammable and explosive hydrogen gas.
- DO NOT use halogenated fire extinguishing agents.

FIRE FIGHTING

- Alert Fire Brigade and tell them location and nature of hazard.
- Wear breathing apparatus plus protective gloves.
- Prevent, by any means available, spillage from entering drains or water course.
- Fight fire from a safe distance, with adequate cover.

When any large container (including road and rail tankers) is involved in a fire, consider evacuation by 800 metres in all directions.

GENERAL FIRE HAZARDS/HAZARDOUS COMBUSTIBLE PRODUCTS

- DO NOT disturb burning dust. Explosion may result if dust is stirred into a cloud, by providing oxygen to a large surface of hot metal.
- DO NOT use water or foam as generation of explosive hydrogen may result.

<. FIRE INCOMPATIBILITY

- Reacts with acids producing flammable / explosive hydrogen (H₂) gas
- Keep dry
- NOTE May develop pressure in containers; open carefully. Vent periodically.

None known.

Section 6 - ACCIDENTAL RELEASE MEASURES

MINOR SPILLS

- Remove all ignition sources.
- DO NOT touch or walk through spilled material.
- Clean up all spills immediately.
- Avoid contact with skin and eyes.

MAJOR SPILLS

- Clear area of personnel and move upwind.
- Alert Fire Brigade and tell them location and nature of hazard.
- DO NOT touch or walk through spilled material.
- Control personal contact by using protective equipment.

Section 7 - HANDLING AND STORAGE

PROCEDURE FOR HANDLING

- Avoid all personal contact, including inhalation.
- Wear protective clothing when risk of overexposure occurs.
- Use in a well-ventilated area.
- Prevent concentration in hollows and sumps.

RECOMMENDED STORAGE METHODS

- Bulk bags Reinforced bags required for dense materials.
- CARE Packing of high density product in light weight metal or plastic packages may result in container collapse with product release
- Heavy gauge metal packages / Heavy gauge metal drums

For low viscosity materials and solids

Drums and jerricans must be of the non-removable head type.

Where a can is to be used as an inner package, the can must have a screwed enclosure.<.

STORAGE REQUIREMENTS

FOR MINOR QUANTITIES

- Store in an indoor fireproof cabinet or in a room of noncombustible construction.
- Provide adequate portable fire-extinguishers in or near the storage area.

FOR PACKAGE STORAGE

- Store in original containers in approved flame-proof area.
- No smoking, naked lights, heat or ignition sources.

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE CONTROLS

Source	Material	TWA ppm	TWA mg/m ³	STEL ppm	STEL mg/m ³	Peak ppm	Peak mg/m ³	TWA F/CC	Notes
Canada - Ontario Occupational Exposure Limits	germanium (Particles (Insoluble or Poorly Soluble) Not Otherwise)		10 (I)						
Canada - British Columbia Occupational Exposure Limits	germanium (Particles (Insoluble or Poorly Soluble) Not Otherwise Classified (PNOC))		10 (N)						
Canada - Ontario Occupational Exposure Limits	germanium (Specified (PNOS) / Particules		3 (R)						

(insolubles ou peu solubles) non précisées par ailleurs)

US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants	germanium (Particulates not otherwise regulated Respirable fraction)	5	
US - California Permissible Exposure Limits for Chemical Contaminants	germanium (Particulates not otherwise regulated Respirable fraction)	5	(n)
US - Oregon Permissible Exposure Limits (Z-1)	germanium (Particulates not otherwise regulated (PNOR) (f) Total Dust)	10	Bold print identifies substances for which the Oregon Permissible Exposure Limits (PELs) are different than the federal Limits. PNOR means "particles not otherwise regulated."
US - Michigan Exposure Limits for Air Contaminants	germanium (Particulates not otherwise regulated, Respirable dust)	5	
US - Oregon Permissible Exposure Limits (Z-1)	germanium (Particulates not otherwise regulated (PNOR) (f) Respirable Fraction)	5	Bold print identifies substances for which the Oregon Permissible Exposure Limits (PELs) are different than the federal Limits. PNOR means "particles not otherwise regulated."
US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants	germanium (Particulates not otherwise regulated (PNOR)(f)-Respirable fraction)	5	

PERSONAL PROTECTION



RESPIRATOR

- Particulate. (AS/NZS 1716 & 1715, EN 1432000 & 1492001, ANSI Z88 or national equivalent)

EYE

- Safety glasses with side shields.
- Chemical goggles.
- Contact lenses may pose a special hazard; soft contact lenses may absorb and concentrate irritants. A written policy document, describing the wearing of lens or restrictions on use, should be created for each workplace or task. This should include a review of lens absorption and adsorption for the class of chemicals in use and an account of injury experience. Medical and first-aid personnel should be trained in their removal and suitable equipment should be readily available. In the event of chemical exposure, begin eye irrigation immediately and remove contact lens as soon as practicable. Lens should be removed at the first signs of eye redness or irritation - lens should be removed in a clean environment only after workers have washed hands thoroughly. [CDC NIOSH Current Intelligence Bulletin 59], [AS/NZS 1336 or national equivalent]

HANDS/FEET

Suitability and durability of glove type is dependent on usage. Important factors in the selection of gloves include

- frequency and duration of contact,
- chemical resistance of glove material,
- glove thickness and
- dexterity
- Protective gloves eg. Leather gloves or gloves with Leather facing
- Wear physical protective gloves, eg. leather.
- Wear safety footwear.

OTHER

- Overalls.
- Eyewash unit.
- Barrier cream.
- Skin cleansing cream.
- Some plastic personal protective equipment (PPE) (e.g. gloves, aprons, overshoes) are not recommended as they may produce static electricity.
- For large scale or continuous use wear tight-weave non-static clothing (no metallic fasteners, cuffs or pockets), non sparking safety footwear.

ENGINEERING CONTROLS

- For large scale or continuous use
- Spark-free, earthed ventilation system, venting directly to the outside and separate from usual ventilation systems
- Provide dust collectors with explosion vents

Metal dusts must be collected at the source of generation as they are potentially explosive.

- Vacuum cleaners, of flame-proof design, should be used to minimise dust accumulation.
- Metal spraying and blasting should, where possible, be conducted in separate rooms. This minimises the risk of supplying oxygen, in the form of metal oxides, to potentially reactive finely divided metals such as aluminium, zinc, magnesium or titanium.
- Work-shops designed for metal spraying should possess smooth walls and a minimum of obstructions, such as ledges, on which dust accumulation is possible.
- Wet scrubbers are preferable to dry dust collectors.

Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL PROPERTIES

Solid.

State	Divided solid	Molecular Weight	72.64
Melting Range (°F)	1719	Viscosity	Not Applicable
Boiling Range (°F)	5126	Solubility in water (g/L)	Reacts
Flash Point (°F)	Not applicable	pH (1% solution)	Not applicable.
Decomposition Temp (°F)	Not Applicable	pH (as supplied)	Not applicable
Autoignition Temp (°F)	Not Applicable	Vapor Pressure (mmHG)	Not applicable
Upper Explosive Limit (%)	Not applicable	Specific Gravity (water=1)	5.323
Lower Explosive Limit (%)	Not applicable	Relative Vapor Density (air=1)	Not applicable
Volatile Component (%vol)	Not applicable	Evaporation Rate	Not applicable

APPEARANCE

Lustrous, brittle metalloid; does not mix with water. In presence of dissolved oxygen attacked by aqua regia, concentrated nitric or sulfuric acid, fused alkalis, alkali peroxides, nitrates or peroxides. Oxidises in air above 600 deg C. Attacked by hydrogen at 1000 deg C. Finely divided powder burns in chlorine and bromine. Germanium occurs mostly in the oxidation state +4 although many compounds are known with the oxidation state of +2. Other oxidation states are rare, such as +3 found in compounds such as Ge₂Cl₆, and +3 and +1 observed on the surface of oxides, or negative oxidation states in germanes, such as -4 in GeH₄. Hardness 6 on Mohs scale. Germanium has five naturally occurring isotopes, ⁷⁰Ge, ⁷²Ge, ⁷³Ge, ⁷⁴Ge, and ⁷⁶Ge. Of these, ⁷⁶Ge is very slightly radioactive, decaying by double beta decay with a half-life of 1.78 × 10²¹ years. ⁷⁴Ge is the most common isotope, having a natural abundance of approximately 36%. ⁷⁶Ge is the least common with a natural abundance of approximately 7%. When bombarded with alpha particles, the isotope ⁷²Ge will generate stable ⁷⁷Se, releasing high energy electrons in the process Data following for finely divided material.

Section 10 - CHEMICAL STABILITY

CONDITIONS CONTRIBUTING TO INSTABILITY

- Presence of heat source and ignition source
- Presence of incompatible materials.
- Product is considered stable.
- Hazardous polymerisation will not occur.

STORAGE INCOMPATIBILITY

- Many metals may incandesce, react violently, ignite or react explosively upon addition of concentrated nitric acid.

Metals exhibit varying degrees of activity. Reaction is reduced in the massive form (sheet, rod, or drop), compared with finely divided forms.

- can react exothermically with oxidising acids to form noxious gases.
- catalyse polymerisation and other reactions, particularly when finely divided
- Many metals in elemental form react exothermically with compounds having active hydrogen atoms (such as acids and water) to form flammable hydrogen gas and caustic products.
- Elemental metals may react with azo/diazo compounds to form explosive products.
- Some elemental metals form explosive products with halogenated hydrocarbons.
- Reacts with acids producing flammable / explosive hydrogen (H₂) gas
- Avoid reaction with oxidising agents
- Finely divided metal powders develop pyrophoricity when a critical specific surface area is exceeded; this is ascribed to high heat of oxide formation on exposure to air.
- Safe handling is possible in relatively low concentrations of oxygen in an inert gas
- Several pyrophoric metals, stored in glass bottles have ignited when the container is broken on impact. Storage of these materials moist and in metal containers is recommended.
- The reaction residues from various metal syntheses (involving vacuum evaporation and co-deposition with a ligand) are often pyrophoric
- Reacts slowly with water.
- CAUTION contamination with moisture will liberate explosive hydrogen gas, causing pressure build up in sealed containers.
- Reacts violently with caustic soda, other alkalis - generating heat, highly flammable hydrogen gas.
- If alkali is dry, heat generated may ignite hydrogen - if alkali is in solution may cause violent foaming

Elemental germanium oxidizes slowly to GeO₂ at 250 C. Germanium is insoluble in dilute acids and alkalis but dissolves slowly in concentrated sulfuric acid and reacts violently with molten alkalis to produce germanates ([GeO₃]²⁻).

For incompatible materials - refer to Section 7 - Handling and Storage.

Section 11 - TOXICOLOGICAL INFORMATION

germanium

TOXICITY AND IRRITATION

- No significant acute toxicological data identified in literature search.

Section 12 - ECOLOGICAL INFORMATION

This material and its container must be disposed of as hazardous waste.

Ecotoxicity

Ingredient	Persistence: Water/Soil	Persistence: Air	Bioaccumulation	Mobility
germanium	No Data Available	No Data Available		

Section 13 - DISPOSAL CONSIDERATIONS

US EPA Waste Number & Descriptions

A. General Product Information

Ignitability characteristic: use EPA hazardous waste number D001 (waste code I)

Disposal Instructions

All waste must be handled in accordance with local, state and federal regulations.

Legislation addressing waste disposal requirements may differ by country, state and/ or territory. Each user must refer to laws operating in their area. In some areas, certain wastes must be tracked.

A Hierarchy of Controls seems to be common - the user should investigate:

- Reduction
- Reuse
- Recycling
- Disposal (if all else fails)

This material may be recycled if unused, or if it has not been contaminated so as to make it unsuitable for its intended use. Shelf life considerations should also be applied in making decisions of this type. Note that properties of a material may change in use, and recycling or reuse may not always be appropriate. In most instances the supplier of the material should be consulted.

- DO NOT allow wash water from cleaning or process equipment to enter drains.
- It may be necessary to collect all wash water for treatment before disposal.
- In all cases disposal to sewer may be subject to local laws and regulations and these should be considered first.
- Where in doubt contact the responsible authority.
- Recycle wherever possible.
- Consult manufacturer for recycling options or consult local or regional waste management authority for disposal if no suitable treatment or disposal facility can be identified.
- Dispose of by: burial in a land-fill specifically licenced to accept chemical and / or pharmaceutical wastes or Incineration in a licenced apparatus (after admixture with suitable combustible material)
- Decontaminate empty containers. Observe all label safeguards until containers are cleaned and destroyed.

Section 14 - TRANSPORTATION INFORMATION

DOT:

Symbols:	None	Hazard class or Division:	4.1
Identification Numbers:	UN3089	PG:	II
Label Codes:	4.1	Special provisions:	IB8, IP2, IP4, T3, TP33
Packaging: Exceptions:	151	Packaging: Non-bulk:	212
Packaging: Exceptions:	151	Quantity limitations: Passenger aircraft/rail:	15 kg
Quantity Limitations: Cargo aircraft only:	50 kg	Vessel stowage: Location:	B
Vessel stowage: Other:	None		

Hazardous materials descriptions and proper shipping names:

Metal powders, flammable, n.o.s.

Air Transport IATA:

ICAO/IATA Class:	4.1	ICAO/IATA Subrisk:	None
UN/ID Number:	3089	Packing Group:	II
Special provisions:	A3		
Cargo Only			
Packing Instructions:	448	Maximum Qty/Pack:	50 kg
Passenger and Cargo		Passenger and Cargo	
Packing Instructions:	445	Maximum Qty/Pack:	15 kg
Passenger and Cargo Limited Quantity		Passenger and Cargo Limited Quantity	
Packing Instructions:	Y441	Maximum Qty/Pack:	5 kg

Shipping name:METAL POWDER, FLAMMABLE, N.O.S.(contains germanium)

Maritime Transport IMDG:

IMDG Class:	4.1	IMDG Subrisk:	None
UN Number:	3089	Packing Group:	II
EMS Number:	F-G,S-G	Special provisions:	None
Limited Quantities:	1 kg		

Shipping name:METAL POWDER, FLAMMABLE, N.O.S.(contains germanium)

Section 15 - REGULATORY INFORMATION

germanium (CAS: 7440-56-4) is found on the following regulatory lists;

"Canada Non-Domestic Substances List (NDSL)", "US DOE Temporary Emergency Exposure Limits (TEELs)", "US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory"

Section 16 - OTHER INFORMATION

LIMITED EVIDENCE

- Inhalation and/or ingestion may produce health damage*.
 - Cumulative effects may result following exposure*.
 - May produce discomfort of the eyes*.
- * (limited evidence).

■ Classification of the preparation and its individual components has drawn on official and authoritative sources as well as independent review by the Chemwatch Classification committee using available literature references.

A list of reference resources used to assist the committee may be found at:

www.chemwatch.net/references.

■ The (M)SDS is a Hazard Communication tool and should be used to assist in the Risk Assessment. Many factors determine whether the reported Hazards are Risks in the workplace or other settings.

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