



This Safety Data Sheet complies with EC Directives 91/155 and 1272/2008

SECTION 1. IDENTIFICATION OF THE SUBSTANCE AND THE COMPANY

Product name	Germanium
Chemical formula	Ge
Synonym	None
EC # (European Chemical Substance)	231-164-3
CAS # (Chemical Abstracts Service)	7440-56-4
Use of the substance	Photovoltaic and semiconductor application
Supplier/manufacturer	Firebird Technologies Inc., a division of 5N Plus Inc. 9200 Industrial Road Trail, British Columbia Canada V1R 4X7
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SECTION 2. HAZARDS IDENTIFICATION

Physical state	Solid
Colour	Grayish-white
Risk status	Low toxicity
Emergency overview	Germanium is not considered an industrial health hazard and has low toxicity.
Routes of entry	Ingestion, inhalation
Potential acute health effects	
Eyes	Exposure to particulates may cause irritation.
Skin	Exposure to particulates may cause skin irritation.
Inhalation	Inhalation of particulates may cause respiratory tract irritation.
Ingestion	May cause gastrointestinal irritation.
Potential chronic health effects	It is concluded from animal experiments that elemental germanium is of low toxicity both acutely & chronically by all routes of administration tested including inhalation.

For toxicological information, see Section 11

SECTION 3. COMPOSITION OF/INFORMATION REGARDING CONSTITUENTS

Name	Symbol	CAS #	EC #	IUPAC Name	Percentage (%)	Classification
Germanium	Ge	7440-56-4	231-164-3	Name	100	Not classified

SECTION 4. FIRST AID

Eye contact	Check for and remove any contact lenses. In the event of contact with eyes, rinse immediately with plenty of water. Get medical attention.
Skin contact	In case of contact, wash affected area with soap and large amounts of water. Remove and wash any contaminated clothing. Dust may provoke skin irritation.
Inhalation	If inhaled, move to fresh air. Get immediate medical attention.
Ingestion	Rare in industry. If the person is unconscious, do not give anything to drink or induce vomiting. Get immediate medical attention.
Note to attending physician	There is no specific antidote. Please contact poison center.

SECTION 5. FIRE FIGHTING MEASURES

Flammability of the product	Moderate in the form of dust when exposed to heat or flame.
Products of combustion	May evolve metal oxides fumes above melting point.
Extinguishing media	
Suitable	Extinguish fire using agent suitable for type of surrounding fire.
Not suitable	None known
Special exposure hazards	Metal oxides fumes can form in the event of fire.
Special protective equipment for firefighters	Firefighters should wear self-contained breathing apparatus (SCBA).

SECTION 6. ACCIDENTAL RELEASE MEASURES

Personal precautions

Safety glasses and impervious gloves. Wear at least a P2 type particle filter respirator if the airborne concentrations are above the exposure limit. If the airborne concentrations are unknown, wear approved self-contained breathing apparatus.

Environmental precautions

Avoid dispersal of spilled material. Prevent runoff and contact with soil, waterways, drains or sewers.

Methods for cleaning-up

Allow molten metal to cool and harden before cleanup. Once solidified vacuum the spilled material with an appropriate vacuum and place in an appropriate container for disposal in a safe place. Avoid creating dusty conditions and prevent wind dispersal.

SECTION 7. HANDLING AND STORAGE

Handling

Avoid contact with skin. Wear protective eyewear and, in the event of insufficient ventilation, a suitable breathing apparatus. Do not eat, drink, or smoke during work. Wash hands, forearms and face thoroughly after handling this product and before eating, smoking or using the lavatory.

Storage

Keep in tightly closed containers. Keep in a dry and well ventilated area away from strong oxidants and strong acids.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Exposure limits values

Product Name	8-hour total weight average (TWA) permissible exposure limit (PEL)	Short Term Exposure Limits (STELs)
Germanium	CANADA-QUEBEC: 10 mg/m ³ (PNOC) USA - OSHA : 15 mg/m ³ for total dust (PNOC) 5 mg/m ³ for respirable dust (PNOR) USA - ACGIH : 10 mg/m ³ for inhalable particles 3 mg/m ³ for respirable dust	N/A

Occupational exposure controls

Environmental exposure controls

Use only in well ventilated areas. If handling generates dust, fumes, Gases, vapor or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.

Eye protection

Safety glasses

Skin protection

The choice of skin protection gear will depend on the nature of the work to perform.

Respiratory protection

If there is a risk of exceeding exposure limits, wear at least a P2 type particle filter respirator.

Hand protection

Natural rubber (latex)

Personal safety equipment pictograms



SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance

Lustrous, brittle metalloid

Odor

Odorless

Color

Grayish-white

Molecular weight

72.59

Molecular formula

Ge

Melting point

937.2°C

pH

Not applicable

Boiling point

2700°C

Flash point

Not applicable

Flammability

Not flammable

Oxidizing properties

Not applicable

Vapor pressure

0 mm/Hg @ 25°C

Relative density

5.323 g/cm³

Solubility

Water solubility

Insoluble

Fat solubility

Insoluble

Partition coefficient

Not applicable

Viscosity

Not available

SECTION 10. STABILITY AND REACTIVITY

Conditions to avoid

The powdered metal reacts violently with nitric acid, and mixtures with potassium chlorate or nitrate explode on heating.

Materials to avoid
Hazardous decomposition products

Nitric acid, chlorine, bromine, potassium chlorate or nitrate.
May evolve metal oxides fumes.

SECTION 11. TOXICOLOGICAL INFORMATION

Toxicological data

Product/ingredient name	Test	Result	Route/Species
Germanium	LCLo (4-hours)	3,860mg/m ³	Inhalation / rat

Acute effects

Eyes Exposure to particulates may cause irritation.
Skin Exposure to particulates may cause skin irritation.
Ingestion Inhalation of particulates may cause respiratory tract irritation.
Inhalation May cause gastrointestinal irritation.

Potential chronic health effects

Carcinogenicity Not applicable
Mutagenicity Not applicable
Teratogenic effects Not applicable

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicity data

Product/ingredient name	Species	Period	Test (LC50)
Germanium	Hyalella azteca	7 days	> 3,150 ug/L

Environmental precautions Observe environmental regulations in place.
Breakdown products This product is insoluble in water
Toxicity of biodegradation products Not available

SECTION 13. DISPOSAL CONSIDERATIONS

Waste disposal The generation of waste should be avoided or minimized wherever possible. Avoid dispersal of spilled material and prevent runoff and contact with soil, waterways, drains or sewers. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional and local authority requirements.

SECTION 14. TRANSPORTATION INFORMATION

Regulatory information	Proper shipping name	Class	UN Number	PG	Labeling
IATA Class	Not classified	Not classified	Not classified	Not classified	Not classified
UN/IMDG	Not classified	Not classified	Not classified	Not classified	Not classified
ADR/RID Class	Not classified	Not classified	Not classified	Not classified	Not classified
GGVSE	Not classified	Not classified	Not classified	Not classified	Not classified

SECTION 15. REGULATORY INFORMATION

EU Regulation *This chemical substance is not classified according to the criteria of the EC Directive 1272/2008*

Hazard Statements Not applicable

SECTION 16. OTHER INFORMATION

References Directive 91/155/EEC
European Commission's Joint Research Centre Databases
EPA Ecotox Databases

Glossary **LCLo**: Indicates the lowest concentration of the chemical that is lethal for the exposed animals.
LD50 - Indicates the dose that is lethal to 50% of an exposed group
PNO : Particulates not otherwise classified
PNOR : Particulates not otherwise regulated

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