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Stanford Advanced Materials

We not only sell products, we provide satisfactions.

360 Goddard, Irvine, CA 92618, USA

Tel: (949) 380-7362 ***Fax:*** (949) 812-6690

Current Version: 2.0
Revision Date: Sep 5, 2012

Material Safety Data Sheet

Identity: Germanium Formula: Ge

SECTION I - GENERAL INFORMATION

Manufacturer: Stanford Advanced Materials (SAM)

The information below is believed to be accurate and represents the best information available to SAM. However, SAM makes no warranty, expressed or implied with respect to such information and assumes no liability resulting from its use.

SECTION II - HAZARDOUS INGREDIENTS/IDENTITY INFORMATION

Molecular weight: 72.61

CAS #	OSHA PEL	ACGIH TLV	%
7440-56-4	N/A	N/A	100%

SECTION III – PHYSICAL/CHEMICAL CHARACTERISTICS

Physical State: Solid

Boiling Point: 2830°C
Melting Point: 937.2 ℃
Solubility in water: None
Rate: NA

Specific Gravity (water=1): 5.32 g/cm^3
Vapor Pressure: 1.1 x 10^{-9} atm
Vapor Density: NA Evaporation

Appearance and odor: Grayish-white metal, Odorless

Section IV - Fire and Explosion Hazard Data:

Flash Point: N/A *Method Used*: *Explosive Limits*: LEL: N/A UEL: N/A

Extinguishing Media:

Use suitable extinguishing agent for surrounding material and type of fire

Special Fire Fighting Procedures:

Firefighters must wear full face, self-contained breathing apparatus with full protective clothing to prevent contact with skin and eyes. Fumes from fire are hazardous. Isolate runoff to prevent environmental pollution.

Unusual Fire and Explosion Hazards:

Massive metal is not considered a fire of explosion hazard. Germanium metal dust or powder may be flammable or explosive when dispersed in the air at high concentrations. When finely divided, germanium burns in chlorine and bromine.

SECTION V - REACTIVITY DATA

Stability: Stable
Conditions to Avoid (stability): Powder reacts violently with concentrated nitric acid. Mixtures with potassium chlorate or potassium nitrate explode when heated.
Incompatibility: Strong oxidizing agents, fused alkalis and halogens. May ignite in bromine, chlorine, fluorine or oxygen

Hazardous Decomposition or Byproducts: Irritating and noxious fumes may be generated by thermal decomposition or combustion. Contact with hydrochloric acid emits volatile germanium tetrachloride, which is corrosive and irritation
Hazardous Polymerization: Will not occur
Conditions to avoid (hazardous polymerization): Contact with hydrochloric acid

SECTION VI - HEALTH HAZARD DATA

Routes of entry: Relatively non-toxic to humans by all routes of exposure.

Health Hazards (Acute and Chronic):

Inhalation: Irritation to the respiratory system

Ingestion: Kidney dysfunction, anemia and liver dysfunction

Skin: Direct contact may cause mechanical irritation, redness and itching

Eye: May cause redness, itching, watering and/or swelling

Carcinogenicity: NTP? No IARC Monographs? No OSHA Regulated? No

Emergency and First Aid Procedures:
Inhalation: Remove victim to fresh air, keep warm and quiet, and give oxygen if breathing is difficult; seek medical attention
Ingestion: Give 1-2 glasses of milk or water and induce vomiting, seek medical attention. Never induce vomiting or give anything by mouth to an unconscious person
Skin: Remove contaminated clothing, brush material off skin, wash affected area with mild soap and water, and seek medical attention if symptoms persist
Eye: Flush eyes with lukewarm water, lifting upper and lower eyelids for at least 15 minutes and seek medical attention

SECTION VII - PRECAUTIONS FOR SAFE HANDLING AND USE

Steps to be taken in case material is released or spilled:
Wear appropriate respiratory and protective equipment specified in section VIII. Isolate spill area, provide ventilation and extinguish sources of ignition. Vacuum up spill using a high efficiency particulate absolute (HEPA) air filter and place in a closed container for proper disposal. Take care not to raise dust.

Waste disposal method:
Dispose of in accordance with state, local, and federal regulations.

Hazard Label Information:
Solid suspected of containing moisture should be thoroughly dried before added to molten bath. Store in cool, dry area and in tightly sealed container. Wash thoroughly after handling.

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SECTION VIII - CONTROL MEASURES

Protective Equipment Summary (Hazard Label Information):
NIOSH approved respirator, impervious gloves, safety glasses, clothes to prevent contact.

Ventilation:

Local Exhaust: To maintain concentration at low exposure levels.
Mechanical (General): Recommended.

Work/Hygienic/Maintenance Practices:
Implement engineering and work practice controls to reduce and maintain concentration of exposure at low levels. Use good housekeeping and sanitation practices. Do not use tobacco or food in work area. Wash thoroughly before eating or smoking. Do not blow dust off clothing or skin with compressed air.

Please be advised that N/A can either mean Not Applicable or No Data Has Been Established

GERMANIUM METAL
MATERIAL SAFETY DATA SHEET

SECTION 1. PRODUCT AND COMPANY IDENTIFICATION

Product Identity: Germanium Metal

NOTE: In the form in which this product is sold it is not regulated. This Material Safety Data Sheet is provided for information only.

MSDS Preparer:
Lattice Materials LLC
516 E. Tamarack St.
Bozeman, MT 59715

Date of Last Review/Edit: April 29, 2003

Product Use: Germanium is used to make elements for infrared optical devices, and in solar arrays and panels to generate electricity. It has also been used in the manufacture of rectifying devices and transistors, in red-fluorescing phosphors, and in dental alloys.

SECTION 2. COMPOSITION / INFORMATION ON INGREDIENTS

Ingredient	Approximate Percent by Weight	C.A.S. Number	Occupational Exposure Limits (OELs)		LD_{50}/LC_{50} Species & Route
Germanium	100	7440-56-4	OSHA PEL	None Established	No Data
			ACGIH TLV	None Established	
			NIOSH REL	None Established	

NOTE: OELs for individual jurisdictions may differ from OSHA PELs. Check with local authorities for the applicable OELs in your jurisdiction. OSHA – Occupational Safety and Health Administration; ACGIH – American Conference of Governmental Industrial Hygienists; NIOSH – National Institute for Occupational Safety and Health. OEL – Occupational Exposure Limit, PEL – Permissible Exposure Limit, TLV – Threshold Limit Value, REL – Recommended Exposure Limit.

Trade Names and Synonyms: None.

SECTION 3. HAZARDS IDENTIFICATION

Emergency Overview: A grayish-white, lustrous metal that does not burn except when dispersed into the air as a fine powder. Germanium is relatively non-toxic and poses little immediate hazard to personnel or the environment in an emergency situation.

Potential Health Effects: Elemental germanium is relatively non-toxic to humans by all routes of exposure. No chronic health effects have been reported in humans occupationally exposed to germanium. It is not considered a human carcinogen by the OSHA, NTP, ACGIH, IARC or EU. (see Toxicological Information, Section 11).

Potential environmental Effects: Germanium has low toxicity and limited bioavailability in the environment. It poses no immediate ecological risk. However, contamination of soil and water should be prevented. (see Ecological Information, Section 12)

SECTION 4. FIRST AID MEASURES

Eye Contact: Flush with warm, running water including under the eyelids, to remove foreign object. If irritation persists, seek medical attention.

Skin Contact: Remove contaminated clothing and wash affected area with soap and warm water.

Inhalation: Remove victim from exposure area to fresh air immediately. If breathing has stopped, give artificial respiration. Medical oxygen may be administered, if available, where breathing is difficult. Seek immediate medical attention.

Ingestion: If victim is conscious, dilute stomach contents with 2-4 cupfuls of water or milk. Do not induce vomiting. Seek medical attention immediately and bring a copy of this MSDS. Never give anything by mouth to an unconscious person.

SECTION 5. FIRE FIGHTING MEASURES

Fire and Explosion Hazards: Massive metal is not considered a fire or explosion hazard. Germanium metal dust or powder may be flammable or explosive when dispersed in the air at high concentrations. When finely divided, germanium burns in chlorine and bromine.

Extinguishing Media: Use any means of extinction appropriate for surrounding fire conditions such as water spray, carbon dioxide, dry chemical, or foam.

Fire Fighting: Fire fighters should be fully trained and wear full protective clothing including an approved, self-contained breathing apparatus which supplies a positive air pressure within a full facepiece mask.

Flashpoint and Method: Not Applicable

Upper and Lower Flammable Limit: Not Applicable

SECTION 6. ACCIDENTAL RELEASE MEASURES

Procedures for Cleanup: Control source of spillage if possible to do so safely. Clean up spilled material immediately, observing precautions in Section 8, Personal Protection and using method which will minimize dust generation (e.g., vacuum solids, dampen material and shovel or wet sweep). Return uncontaminated spilled material to the process if possible. Place contaminated materials in suitable labeled containers for recovery or disposal. Treat or dispose of waste material in accordance with all local, regional, and national requirements.

Personal Precautions: Protective clothing, gloves, and respirator equipment are recommended for persons exposed to potentially hazardous levels of germanium dust. Close-fitting safety goggles may be necessary in some circumstances to prevent eye contact with the dust.

Environmental Precautions: Germanium metal is considered to have low toxicity. However, there is limited information on the effects and fate of germanium in the environment. Good management practices should be applied in the storage and use of germanium and its compounds.

SECTION 7. HANDLING AND STORAGE

Store germanium in a dry, covered area away from incompatible materials and protect from physical damage. Solid metal suspected of containing moisture should be THOROUGHLY DRIED before being added to a molten bath, otherwise residual moisture could expand explosively and spatter molten metal out of the bath. Always practice good personal hygiene. Refrain from eating, drinking, or smoking in work areas. Thoroughly wash hands in appropriate, designated areas before eating, drinking, or smoking. No special packaging materials are required.

SECTION 8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Protective Clothing: Gloves and coveralls or other work clothing are recommended to prevent prolonged or repeated direct skin contact when germanium is processed. Eye protection should be worn where fume or dust is generated. Where hot or molten metal is handled, heat resistant gloves, goggles or faceshield, and clothing to protect from hot metal splash should be worn. Safety type boots are recommended.

Ventilation: Use adequate local or general ventilation to maintain the concentration of germanium/germanium dioxide fumes in the working environment as low as practicable. Supply sufficient replacement air to make up for air removed by the exhaust system.

Respirators: Where germanium or germanium dioxide fumes are generated and cannot be controlled to within acceptable levels by engineering means, use appropriate NIOSH-approved respiratory protection equipment (a 42CFR84 Class N, R. or P-95 particulate filter cartridge).

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Grey-white metalliod	**Odor:** None	**Physical State** Solid	**pH** Not Applicable
Vapor Pressure: Negligible	**Vapor Density:** Not Applicable	**Boiling Point/Range:** 2830°C	**Freezing/Melting Point Range:** 937°C
Specific Gravity: 5.35	**Evaporation Rate:** Not Applicable	**Coefficient of Water/Oil Distribution:** Not Applicable	**Odor Threshold:** None
Solubility: Insoluble in water			

SECTION 10. STABILITY AND REACTIVITY

Stability & Reactivity: Massive metal is stable under normal temperatures and pressures.

Incompatibilities: Powdered germanium metal reacts violently with concentrated nitric acid. Mixtures with potassium chlorate or potassium nitrate explode when heated. It is incompatible with strong oxidizing agents,

fused alkalis and halogens. The powdered metal also ignites in atmospheres of bromine, chlorine, fluorine or oxygen. It is soluble in aqua regia and hot concentrated sulphuric acid.

Hazardous Decomposition Products: Irritating and noxious fumes may be generated by thermal decomposition or combustion. Contact between germanium dioxide and hydrochloric acid emits volatile germanium tetrachloride, which is corrosive and irritating.

SECTION 11. TOXICOLOGICAL INFORMATION

General: On the basis of both animal experiments and industrial experience it is believed that elemental germanium and germanium dioxide are of low toxicity both acutely and chronically by all routes of administration including inhalation.

Acute:
Skin/Eyes: Direct contact with skin or eyes may cause mild local mechanical irritation.

Inhalation: Inhalation of germanium dust may be irritating to the respiratory system. Symptoms may include coughing, sneezing and/or shortness of breath.

Ingestion: A few cases of acute overdose by ingestion have been reported in humans. They have generally resulted in renal dysfunction and failure, anemia and hepatotoxicity.

Chronic: Prolonged exposure has been shown to affect the kidneys (renal dysfunction) and the liver (hepatotoxicity) as well as occasionally affecting the muscles and nervous system. Germanium is not listed as a human carcinogen by the Occupational Safety and Health Administration (OSHA), the National Toxicology Program (NTP), the International Agency for Research on Cancer (IARC), or the American Conference of Governmental Industrial Hygienist (ACGIH).

SECTION 12. ECOLOGICAL INFORMATION

As a metal, germanium is insoluble and therefore, presents minimal environmental risk. However, little is known about the toxicity of germanium compounds and care should be taken to prevent environmental contamination.

SECTION 13. DISPOSAL CONSIDERATIONS

If material cannot be returned to process, dispose of only in accordance with applicable regulations.

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