

**$Mn_{3-x}Co_xGa$  ( $0 \leq x \leq 0.5$ , Heusler alloy)**

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## Preparation of target:

$Mn_{3-x}Co_xGa$  (Heusler alloy) samples were prepared by arc melting of stoichiometric amounts of the constituent elements in an argon atmosphere at Magnetic Material Lab, Physics Department IITB. Purity of constituent elements are following,

**Mn:** 99.98 % (Alfa Aesar)

**Co:** 99.95 % (Alfa Aesar)

**Ga:** 99.9999 % (Alfa Aesar)

The MSDS of this alloy is not available. However the MSDS of constituent elements can be find below.

**1 Identification****Product identifier****Product name:** Manganese granules**Stock number:** 36215**CAS Number:**

7439-96-5

**EC number:**



231-105-1

**Relevant identified uses of the substance or mixture and uses advised against.****Identified use:** SU24 Scientific research and development**Details of the supplier of the safety data sheet****Manufacturer/Supplier:**Alfa Aesar  
Thermo Fisher Scientific Chemicals, Inc.  
30 Bond Street  
Ward Hill, MA 01835-8099  
Tel: 800-343-0660  
Fax: 800-322-4757  
Email: tech@alfa.com  
www.alfa.com**Information Department:** Health, Safety and Environmental Department**Emergency telephone number:**

During normal business hours (Monday-Friday, 8am-7pm EST), call (800) 343-0660. After normal business hours, call Carechem 24 at (866) 928-0789.

**2 Hazard(s) identification****Classification of the substance or mixture in accordance with 29 CFR 1910 (OSHA HCS)**

The substance is not classified according to the Globally Harmonized System (GHS).

**Hazards not otherwise classified** No information known.**Label elements****GHS label elements** Not applicable**Hazard pictograms** Not applicable**Signal word** Not applicable**Hazard statements** Not applicable**WHMIS classification** Not controlled**Classification system****HMIS ratings (scale 0-4)****(Hazardous Materials Identification System)** Health (acute effects) = 0 Flammability = 0 Physical Hazard = 0**Other hazards****Results of PBT and vPvB assessment****PBT:** Not applicable.**vPvB:** Not applicable.**3 Composition/information on ingredients****Chemical characterization: Substances****CAS# Description:**

7439-96-5 Manganese

**Identification number(s):****EC number:** 231-105-1**4 First-aid measures****Description of first aid measures****General information** No special measures required.**After inhalation** Seek medical treatment in case of complaints.**After skin contact** Generally the product does not irritate the skin.**After eye contact** Rinse opened eye for several minutes under running water. If symptoms persist, consult a doctor.**After swallowing** If symptoms persist consult doctor.**Information for doctor****Most important symptoms and effects, both acute and delayed** No further relevant information available.**Indication of any immediate medical attention and special treatment needed** No further relevant information available.**5 Fire-fighting measures****Extinguishing media****Suitable extinguishing agents** Special powder for metal fires. Do not use water.**For safety reasons unsuitable extinguishing agents** Water**Special hazards arising from the substance or mixture**

If this product is involved in a fire, the following can be released:

Manganese oxides

**Advice for firefighters****Protective equipment:** No special measures required.**6 Accidental release measures****Personal precautions, protective equipment and emergency procedures** Not required.**Environmental precautions:** Do not allow material to be released to the environment without proper governmental permits.**Methods and material for containment and cleaning up:** Pick up mechanically.**Prevention of secondary hazards:** No special measures required.**Reference to other sections**

See Section 7 for information on safe handling

See Section 8 for information on personal protection equipment.

See Section 13 for disposal information.

Product name: **Manganese granules**

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## 7 Handling and storage

### Handling

#### Precautions for safe handling

Keep container tightly sealed.  
Store in cool, dry place in tightly closed containers.  
**Information about protection against explosions and fires:** No special measures required.

#### Conditions for safe storage, including any incompatibilities

**Storage**  
**Requirements to be met by storerooms and receptacles:** No special requirements.  
**Information about storage in one common storage facility:** No information known.

#### Further information about storage conditions:

Keep container tightly sealed.  
Store in cool, dry conditions in well sealed containers.  
**Specific end use(s)** No further relevant information available.

## 8 Exposure controls/personal protection

**Additional information about design of technical systems:** No further data; see section 7.

### Control parameters

#### Components with limit values that require monitoring at the workplace:

##### 7439-96-5 Manganese (100.0%)

PEL (USA)	Ceiling limit value: 5 mg/m <sup>3</sup> as Mn
REL (USA)	Short-term value: 3 mg/m <sup>3</sup> Long-term value: 1 mg/m <sup>3</sup> fume, as Mn
TLV (USA)	Long-term value: 0.02 * 0.1 * mg/m <sup>3</sup> as Mn; *respirable **inhalable fraction
EL (Canada)	Long-term value: 0.2 mg/m <sup>3</sup> as Mn; R
EV (Canada)	Long-term value: 0.2 mg/m <sup>3</sup> as manganese

**Additional information:** No data

### Exposure controls

#### Personal protective equipment

#### General protective and hygienic measures

The usual precautionary measures for handling chemicals should be followed.  
Maintain an ergonomically appropriate working environment.

**Breathing equipment:** Not required.

**Protection of hands:** Not required.

**Penetration time of glove material (in minutes)** Not determined

**Eye protection:** Safety glasses

**Body protection:** Protective work clothing.

## 9 Physical and chemical properties

### Information on basic physical and chemical properties

#### General Information

##### Appearance:

**Form:** Solid in various forms  
**Color:** Grey  
**Odor:** Odorless  
**Odor threshold:** Not determined.

**pH-value:** Not applicable.

##### Change in condition

**Melting point/Melting range:** 1246 °C (2275 °F)  
**Boiling point/Boiling range:** 2095 °C (3803 °F)  
**Sublimation temperature / start:** Not determined.

**Flammability (solid, gaseous)** Not determined.

**Ignition temperature:** Not determined

**Decomposition temperature:** Not determined

**Auto igniting:** Not determined.

**Danger of explosion:** Not determined.

**Explosion limits:**

**Lower:** Not determined

**Upper:** Not determined

**Vapor pressure at 20 °C (68 °F):** 0 hPa

**Density at 20 °C (68 °F):** 7.3 g/cm<sup>3</sup> (60.919 lbs/gal)

**Relative density** Not determined.

**Vapor density** Not applicable.

**Evaporation rate** Not applicable.

##### Solubility in / Miscibility with

**Water:** Insoluble

**Partition coefficient (n-octanol/water):** Not determined.

##### Viscosity:

**dynamic:** Not applicable.

**kinematic:** Not applicable.

**Other information** No further relevant information available.

## 10 Stability and reactivity

**Reactivity** No information known.

**Chemical stability** Stable under recommended storage conditions.

**Thermal decomposition / conditions to be avoided:** Decomposition will not occur if used and stored according to specifications.

**Possibility of hazardous reactions** No dangerous reactions known

**Conditions to avoid** No further relevant information available.

**Incompatible materials:** No information known.

(Contd. on page 3)  
USA

**Product name: Manganese granules**

**Hazardous decomposition products:** Manganese oxides

(Contd. of page 2)

**11 Toxicological information**

**Information on toxicological effects**

**Acute toxicity:** The Registry of Toxic Effects of Chemical Substances (RTECS) contains acute toxicity data for this substance.

**LD/LC50 values that are relevant for classification:** No data

**Skin irritation or corrosion:** Powder: irritant effect

**Eye irritation or corrosion:** Powder: irritant effect

**Sensitization:** No sensitizing effects known.

**Germ cell mutagenicity:** The Registry of Toxic Effects of Chemical Substances (RTECS) contains mutation data for this substance.

**Carcinogenicity:**

EPA-D: Not classifiable as to human carcinogenicity: inadequate human and animal evidence of carcinogenicity or no data are available.

The Registry of Toxic Effects of Chemical Substances (RTECS) contains tumorigenic and/or carcinogenic and/or neoplastic data for this substance.

**Reproductive toxicity:** The Registry of Toxic Effects of Chemical Substances (RTECS) contains reproductive data for this substance.

**Specific target organ system toxicity - repeated exposure:** No effects known.

**Specific target organ system toxicity - single exposure:** No effects known.

**Aspiration hazard:** No effects known.

**Subacute to chronic toxicity:** The Registry of Toxic Effects of Chemical Substances (RTECS) contains multiple dose toxicity data for this substance.

**Additional toxicological information:** To the best of our knowledge the acute and chronic toxicity of this substance is not fully known.

**12 Ecological information**

**Toxicity**

**Aquatic toxicity:** No further relevant information available.

**Persistence and degradability** No further relevant information available.

**Bioaccumulative potential** No further relevant information available.

**Mobility in soil** No further relevant information available.

**Additional ecological information:**

**General notes:**

Do not allow material to be released to the environment without proper governmental permits.

Do not allow undiluted product or large quantities to reach ground water, water course or sewage system.

Avoid transfer into the environment.

**Results of PBT and vPvB assessment**

**PBT:** Not applicable.

**vPvB:** Not applicable.

**Other adverse effects** No further relevant information available.

**13 Disposal considerations**

**Waste treatment methods**

**Recommendation** Consult state, local or national regulations to ensure proper disposal.

**Uncleaned packagings:**

**Recommendation:** Disposal must be made according to official regulations.

**14 Transport information**

**UN-Number**

DOT, ADN, IMDG, IATA

Not applicable

**UN proper shipping name**

DOT, ADN, IMDG, IATA

Not applicable

**Transport hazard class(es)**

DOT, ADR, ADN, IMDG, IATA

Class

Not applicable

**Packing group**

DOT, IMDG, IATA

Not applicable

**Environmental hazards:**

Not applicable.

**Special precautions for user**

Not applicable.

**Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code** Not applicable.

**Transport/Additional information:**

DOT

**Marine Pollutant (DOT):**

No

**UN "Model Regulation":**

-

**15 Regulatory information**

**Safety, health and environmental regulations/legislation specific for the substance or mixture**

**GHS label elements** Not applicable

**Hazard pictograms** Not applicable

**Signal word** Not applicable

**Hazard statements** Not applicable

**National regulations**

All components of this product are listed in the U.S. Environmental Protection Agency Toxic Substances Control Act Chemical substance Inventory.

All components of this product are listed on the Canadian Domestic Substances List (DSL).

**SARA Section 313 (specific toxic chemical listings)**

7439-96-5 Manganese

**California Proposition 65**

**Prop 65 - Chemicals known to cause cancer** Substance is not listed.

**Prop 65 - Developmental toxicity** Substance is not listed.

**Prop 65 - Developmental toxicity, female** Substance is not listed.

**Prop 65 - Developmental toxicity, male** Substance is not listed.

**Information about limitation of use:** For use only by technically qualified individuals.

**Other regulations, limitations and prohibitive regulations**

**Substance of Very High Concern (SVHC) according to the REACH Regulations (EC) No. 1907/2006.** Substance is not listed.

**The conditions of restrictions according to Article 67 and Annex XVII of the Regulation (EC) No 1907/2006 (REACH) for the manufacturing, placing on the market and use must be observed.**

Substance is not listed.

**Annex XIV of the REACH Regulations (requiring Authorisation for use)** Substance is not listed.

(Contd. on page 4)

**Product name: Manganese granules**

**Chemical safety assessment:** A Chemical Safety Assessment has not been carried out.

(Contd. of page 3)

**16 Other information**

Employers should use this information only as a supplement to other information gathered by them, and should make independent judgement of suitability of this information to ensure proper use and protect the health and safety of employees. This information is furnished without warranty, and any use of the product not in conformance with this Material Safety Data Sheet, or in combination with any other product or process, is the responsibility of the user.

**Department issuing SDS:** Global Marketing Department

**Date of preparation / last revision** 11/23/2015 / -

**Abbreviations and acronyms:**

RID: Règlement international concernant le transport des marchandises dangereuses par chemin de fer (Regulations Concerning the International Transport of Dangerous Goods by Rail)

ICAO: International Civil Aviation Organization

ADR: Accord européen sur le transport des marchandises dangereuses par Route (European Agreement concerning the International Carriage of Dangerous Goods by Road)

IMDG: International Maritime Code for Dangerous Goods

DOT: US Department of Transportation

IATA: International Air Transport Association

EINECS: European Inventory of Existing Commercial Chemical Substances

CAS: Chemical Abstracts Service (division of the American Chemical Society)

HMIS: Hazardous Materials Identification System (USA)

WHMIS: Workplace Hazardous Materials Information System (Canada)

LC50: Lethal concentration, 50 percent

LD50: Lethal dose, 50 percent

vPvB: very Persistent and very Bioaccumulative

ACGIH: American Conference of Governmental Industrial Hygienists (USA)

OSHA: Occupational Safety and Health Administration (USA)

NTP: National Toxicology Program (USA)

IARC: International Agency for Research on Cancer

EPA: Environmental Protection Agency (USA)

**1 Identification****Product identifier****Product name:** Cobalt rod**Stock number:** 43032**CAS Number:**

7440-48-4

**EC number:**

231-158-0

**Index number:**

027-001-00-9

**Relevant identified uses of the substance or mixture and uses advised against.****Identified use:** SU24 Scientific research and development**Details of the supplier of the safety data sheet****Manufacturer/Supplier:**

Alfa Aesar

Thermo Fisher Scientific Chemicals, Inc.

30 Bond Street

Ward Hill, MA 01835-8099

Tel: 800-343-0660

Fax: 800-322-4757

Email: tech@alfa.com

www.alfa.com

**Information Department:** Health, Safety and Environmental Department**Emergency telephone number:**

During normal business hours (Monday-Friday, 8am-7pm EST), call (800) 343-0660. After normal business hours, call Carechem 24 at (866) 928-0789.

**2 Hazard(s) identification****Classification of the substance or mixture in accordance with 29 CFR 1910 (OSHA HCS)**

GHS08 Health hazard

Resp. Sens. 1 H334 May cause allergy or asthma symptoms or breathing difficulties if inhaled.



GHS07

Skin Sens. 1 H317 May cause an allergic skin reaction.

**Hazards not otherwise classified** No information known.**Label elements****GHS label elements** The product is classified and labeled in accordance with 29 CFR 1910 (OSHA HCS)**Hazard pictograms**

GHS08

**Signal word** Danger**Hazard statements**

H334 May cause allergy or asthma symptoms or breathing difficulties if inhaled.

H317 May cause an allergic skin reaction.

**Precautionary statements**

P284 In case of inadequate ventilation wear respiratory protection.

P261 Avoid breathing dust/fume/gas/mist/vapours/spray.

P280 Wear protective gloves/protective clothing/eye protection/face protection.

P342+P311 If experiencing respiratory symptoms: Call a POISON CENTER/doctor/...

P363 Wash contaminated clothing before reuse.

P501 Dispose of contents/container in accordance with local/regional/national/international regulations.

**WHMIS classification**

D2A - Very toxic material causing other toxic effects

**Classification system****HMIS ratings (scale 0-4)****(Hazardous Materials Identification System)****HEALTH** 0 Health (acute effects) = 0**FIRE** 0 Flammability = 0**REACTIVITY** 0 Physical Hazard = 0**Other hazards****Results of PBT and vPvB assessment****PBT:** Not applicable.**vPvB:** Not applicable.**3 Composition/information on ingredients****Chemical characterization: Substances****CAS# Description:**

7440-48-4 Cobalt

**Identification number(s):****EC number:** 231-158-0**Index number:** 027-001-00-9**4 First-aid measures****Description of first aid measures****General information** No special measures required.

Product name: **Cobalt rod**

(Contd. of page 1)

**After inhalation**

Supply fresh air and to be sure call for a doctor.  
Seek medical treatment in case of complaints.

**After skin contact** Generally the product does not irritate the skin.

**After eye contact** Rinse opened eye for several minutes under running water. If symptoms persist, consult a doctor.

**After swallowing** If symptoms persist consult doctor.

**Information for doctor**

**Most important symptoms and effects, both acute and delayed** No further relevant information available.

**Indication of any immediate medical attention and special treatment needed** No further relevant information available.

**5 Fire-fighting measures**

**Extinguishing media**

**Suitable extinguishing agents** Special powder for metal fires. Do not use water.

**For safety reasons unsuitable extinguishing agents** Water

**Special hazards arising from the substance or mixture**

If this product is involved in a fire, the following can be released:

Cobalt oxides

**Advice for firefighters**

**Protective equipment:** No special measures required.

**6 Accidental release measures**

**Personal precautions, protective equipment and emergency procedures** Not required.

**Environmental precautions:** Do not allow material to be released to the environment without proper governmental permits.

**Methods and material for containment and cleaning up:** Dispose of contaminated material as waste according to section 13.

**Prevention of secondary hazards:** No special measures required.

**Reference to other sections**

See Section 7 for information on safe handling

See Section 8 for information on personal protection equipment.

See Section 13 for disposal information.

**7 Handling and storage**

**Handling**

**Precautions for safe handling**

Keep container tightly sealed.

Store in cool, dry place in tightly closed containers.

Ensure good ventilation at the workplace.

Prevent formation of dust.

**Information about protection against explosions and fires:** No special measures required.

**Conditions for safe storage, including any incompatibilities**

**Storage**

**Requirements to be met by storerooms and receptacles:** No special requirements.

**Information about storage in one common storage facility:** Do not store together with acids.

**Further information about storage conditions:**

Keep container tightly sealed.

Store in cool, dry conditions in well sealed containers.

**Specific end use(s)** No further relevant information available.

**8 Exposure controls/personal protection**

**Additional information about design of technical systems:** No further data; see section 7.

**Control parameters**

**Components with limit values that require monitoring at the workplace:**

**7440-48-4 Cobalt (100.0%)**

PEL (USA) Long-term value: 0.1\* mg/m<sup>3</sup>  
as Co; \*for metal dust and fume

REL (USA) Long-term value: 0.05 mg/m<sup>3</sup>  
as Co; metal dust & fume

TLV (USA) Long-term value: 0.02 mg/m<sup>3</sup>  
as Co, BEI

EL (Canada) Long-term value: 0.02 mg/m<sup>3</sup>  
IARC 2B

EV (Canada) Long-term value: 0.1 mg/m<sup>3</sup>

**Ingredients with biological limit values:**

**7440-48-4 Cobalt (100.0%)**

BEI (USA) 15 µg/L  
Medium: urine  
Time: end of shift at end of workweek  
Parameter: Cobalt (background)

1 µg/L  
Medium: blood  
Time: end of shift at end of workweek  
Parameter: Cobalt (background, semi-quantitative)

**Additional information:** No data

**Exposure controls**

**Personal protective equipment**

**General protective and hygienic measures**

The usual precautionary measures for handling chemicals should be followed.

Maintain an ergonomically appropriate working environment.

**Breathing equipment:** Not required.

**Protection of hands:** Not required.

**Penetration time of glove material (in minutes)** Not determined

**Eye protection:** Safety glasses

**Body protection:** Protective work clothing.



Product name: **Cobalt rod**

(Contd. of page 2)

### 9 Physical and chemical properties

#### Information on basic physical and chemical properties

##### General Information

##### Appearance:

**Form:** Solid in various forms  
**Color:** Grey  
**Odor:** Odorless  
**Odor threshold:** Not determined.

**pH-value:** Not applicable.

##### Change in condition

**Melting point/Melting range:** 1495 °C (2723 °F)  
**Boiling point/Boiling range:** 2927 °C (5301 °F)  
**Sublimation temperature / start:** Not determined  
**Flammability (solid, gaseous)** Not determined.  
**Ignition temperature:** Not determined  
**Decomposition temperature:** Not determined  
**Auto igniting:** Not determined.

##### Danger of explosion:

**Explosion limits:** Not determined.  
**Lower:** Not determined  
**Upper:** Not determined  
**Vapor pressure at 994 °C (1821 °F):** 0.0000001 hPa  
**Density at 20 °C (68 °F):** 8.92 g/cm<sup>3</sup> (74.437 lbs/gal)

**Bulk density at 20 °C (68 °F):** 850 kg/m<sup>3</sup>  
**Relative density** Not determined.  
**Vapor density** Not applicable.  
**Evaporation rate** Not applicable.  
**Solubility in / Miscibility with**  
**Water:** Insoluble  
**Partition coefficient (n-octanol/water):** Not determined.  
**Viscosity:**  
**dynamic:** Not applicable.  
**kinematic:** Not applicable.  
**Other information** No further relevant information available.

### 10 Stability and reactivity

**Reactivity** No information known.

**Chemical stability** Stable under recommended storage conditions.

**Thermal decomposition / conditions to be avoided:** Decomposition will not occur if used and stored according to specifications.

**Possibility of hazardous reactions** No dangerous reactions known

**Conditions to avoid** No further relevant information available.

**Incompatible materials:** Acids

**Hazardous decomposition products:** Cobalt oxides

### 11 Toxicological information

#### Information on toxicological effects

**Acute toxicity:** The Registry of Toxic Effects of Chemical Substances (RTECS) contains acute toxicity data for this substance.

#### LD/LC50 values that are relevant for classification:

Oral | LD50 | 6171 mg/kg (rat)

**Skin irritation or corrosion:** No irritant effect.

**Eye irritation or corrosion:** May cause irritation

#### Sensitization:

May cause allergy or asthma symptoms or breathing difficulties if inhaled.

May cause an allergic skin reaction.

**Germ cell mutagenicity:** The Registry of Toxic Effects of Chemical Substances (RTECS) contains mutation data for this substance.

#### Carcinogenicity:

IARC-2B: Possibly carcinogenic to humans: limited evidence in humans in the absence of sufficient evidence in experimental animals.

ACGIH A3: Animal carcinogen: Agent is carcinogenic in experimental animals at a relatively high dose, by route(s) of administration, at site(s), of histologic type(s), or by mechanism(s) not considered relevant to worker exposure. Available epidemiologic studies do not confirm an increased risk of cancer in exposed humans.

Available evidence suggests that the agent is not likely to cause cancer in humans except under uncommon or unlikely routes or levels of exposure.

The Registry of Toxic Effects of Chemical Substances (RTECS) contains tumorigenic and/or carcinogenic and/or neoplastic data for this substance.

**Reproductive toxicity:** No effects known.

**Specific target organ system toxicity - repeated exposure:** No effects known.

**Specific target organ system toxicity - single exposure:** No effects known.

**Aspiration hazard:** No effects known.

**Subacute to chronic toxicity:** The Registry of Toxic Effects of Chemical Substances (RTECS) contains multiple dose toxicity data for this substance.

**Additional toxicological information:** To the best of our knowledge the acute and chronic toxicity of this substance is not fully known.

### 12 Ecological information

#### Toxicity

**Aquatic toxicity:** No further relevant information available.

**Persistence and degradability** No further relevant information available.

**Bioaccumulative potential** No further relevant information available.

**Mobility in soil** No further relevant information available.

#### Additional ecological information:

##### General notes:

Do not allow material to be released to the environment without proper governmental permits.

Do not allow undiluted product or large quantities to reach ground water, water course or sewage system.

May cause long lasting harmful effects to aquatic life.

Avoid transfer into the environment.

#### Results of PBT and vPvB assessment

**PBT:** Not applicable.

**vPvB:** Not applicable.

**Other adverse effects** No further relevant information available.

Product name: **Cobalt rod**

(Contd. of page 3)

### 13 Disposal considerations

**Waste treatment methods**

**Recommendation** Consult state, local or national regulations to ensure proper disposal.

**Uncleaned packagings:**

**Recommendation:** Disposal must be made according to official regulations.

### 14 Transport information

**UN-Number**

**DOT, ADN, IMDG, IATA** Not applicable

**UN proper shipping name**

**DOT, ADN, IMDG, IATA** Not applicable

**Transport hazard class(es)**

**DOT, ADR, ADN, IMDG, IATA**  
**Class** Not applicable

**Packing group**

**DOT, IMDG, IATA** Not applicable

**Environmental hazards:**

Not applicable.

**Special precautions for user**

Not applicable.

**Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code** Not applicable.

**Transport/Additional information:**

**DOT**

**Marine Pollutant (DOT):** No

**UN "Model Regulation":** -

### 15 Regulatory information

**Safety, health and environmental regulations/legislation specific for the substance or mixture**

**GHS label elements** The product is classified and labeled in accordance with 29 CFR 1910 (OSHA HCS)

**Hazard pictograms**



GHS08

**Signal word** Danger

**Hazard statements**

H334 May cause allergy or asthma symptoms or breathing difficulties if inhaled.

H317 May cause an allergic skin reaction.

**Precautionary statements**

P284 In case of inadequate ventilation wear respiratory protection.

P261 Avoid breathing dust/fume/gas/mist/vapours/spray.

P280 Wear protective gloves/protective clothing/eye protection/face protection.

P342+P311 If experiencing respiratory symptoms: Call a POISON CENTER/doctor/...

P363 Wash contaminated clothing before reuse.

P501 Dispose of contents/container in accordance with local/regional/national/international regulations.

**National regulations**

All components of this product are listed in the U.S. Environmental Protection Agency Toxic Substances Control Act Chemical substance Inventory.

All components of this product are listed on the Canadian Domestic Substances List (DSL).

**SARA Section 313 (specific toxic chemical listings)**

7440-48-4 Cobalt

**California Proposition 65**

**Prop 65 - Chemicals known to cause cancer**

7440-48-4 Cobalt

**Prop 65 - Developmental toxicity** Substance is not listed.

**Prop 65 - Developmental toxicity, female** Substance is not listed.

**Prop 65 - Developmental toxicity, male** Substance is not listed.

**Information about limitation of use:** For use only by technically qualified individuals.

**Other regulations, limitations and prohibitive regulations**

**Substance of Very High Concern (SVHC) according to the REACH Regulations (EC) No. 1907/2006.** Substance is not listed.

**The conditions of restrictions according to Article 67 and Annex XVII of the Regulation (EC) No 1907/2006 (REACH) for the manufacturing, placing on the market and use must be observed.**

Substance is not listed.

**Annex XIV of the REACH Regulations (requiring Authorisation for use)** Substance is not listed.

**Chemical safety assessment:** A Chemical Safety Assessment has not been carried out.

### 16 Other information

Employers should use this information only as a supplement to other information gathered by them, and should make independent judgement of suitability of this information to ensure proper use and protect the health and safety of employees. This information is furnished without warranty, and any use of the product not in conformance with this Material Safety Data Sheet, or in combination with any other product or process, is the responsibility of the user.

**Department issuing SDS:** Global Marketing Department

**Date of preparation / last revision** 11/24/2015 / -

**Abbreviations and acronyms:**

RID: Règlement international concernant le transport des marchandises dangereuses par chemin de fer (Regulations Concerning the International Transport of Dangerous Goods by Rail)

ICAO: International Civil Aviation Organization

ADR: Accord européen sur le transport des marchandises dangereuses par Route (European Agreement concerning the International Carriage of Dangerous Goods by Road)

IMDG: International Maritime Code for Dangerous Goods

DOT: US Department of Transportation

IATA: International Air Transport Association

EINECS: European Inventory of Existing Commercial Chemical Substances

CAS: Chemical Abstracts Service (division of the American Chemical Society)

HMIS: Hazardous Materials Identification System (USA)

WHMIS: Workplace Hazardous Materials Information System (Canada)

LC50: Lethal concentration, 50 percent

LD50: Lethal dose, 50 percent

vPvB: very Persistent and very Bioaccumulative

ACGIH: American Conference of Governmental Industrial Hygienists (USA)

OSHA: Occupational Safety and Health Administration (USA)

NTP: National Toxicology Program (USA)

(Contd. on page 5)

USA

**Product name: Cobalt rod**

IARC: International Agency for Research on Cancer  
EPA: Environmental Protection Agency (USA)

(Contd. of page 4)

USA

**1 Identification****Product identifier****Product name:** Gallium pellets**Stock number:** 44324**CAS Number:**

7440-55-3

**EC number:**

231-163-8

**Relevant identified uses of the substance or mixture and uses advised against.****Identified use:** SU24 Scientific research and development**Details of the supplier of the safety data sheet****Manufacturer/Supplier:**Alfa Aesar  
Thermo Fisher Scientific Chemicals, Inc.  
30 Bond Street  
Ward Hill, MA 01835-8099  
Tel: 800-343-0660  
Fax: 800-322-4757  
Email: tech@alfa.com  
www.alfa.com**Information Department:** Health, Safety and Environmental Department**Emergency telephone number:**

During normal business hours (Monday-Friday, 8am-7pm EST), call (800) 343-0660. After normal business hours, call Carechem 24 at (866) 928-0789.

**2 Hazard(s) identification****Classification of the substance or mixture in accordance with 29 CFR 1910 (OSHA HCS)**

GHS05 Corrosion

Met. Corr.1 H290 May be corrosive to metals.

**Hazards not otherwise classified** No information known.**Label elements****GHS label elements** The product is classified and labeled in accordance with 29 CFR 1910 (OSHA HCS)**Hazard pictograms**

GHS05

**Signal word** Warning**Hazard statements**

H290 May be corrosive to metals.

**Precautionary statements**

P234 Keep only in original container.

P390 Absorb spillage to prevent material damage.

P406 Store in corrosive resistant container with a resistant inner liner.

**WHMIS classification**

E - Corrosive material

**Classification system****HMIS ratings (scale 0-4)****(Hazardous Materials Identification System)****HEALTH** 1 Health (acute effects) = 1**FIRE** 0 Flammability = 0**REACTIVITY** 1 Physical Hazard = 1**Other hazards****Results of PBT and vPvB assessment****PBT:** Not applicable.**vPvB:** Not applicable.**3 Composition/information on ingredients****Chemical characterization: Substances****CAS# Description:**

7440-55-3 Gallium

**Identification number(s):****EC number:** 231-163-8**4 First-aid measures****Description of first aid measures****After inhalation**

Supply fresh air. If required, provide artificial respiration. Keep patient warm.

Seek immediate medical advice.

**After skin contact**

Immediately wash with water and soap and rinse thoroughly.

Seek immediate medical advice.

**After eye contact** Rinse opened eye for several minutes under running water. Then consult a doctor.**After swallowing** Seek medical treatment.**Information for doctor****Most important symptoms and effects, both acute and delayed** No further relevant information available.**Indication of any immediate medical attention and special treatment needed** No further relevant information available.

Product name: **Gallium pellets**

(Contd. of page 1)

## 5 Fire-fighting measures

### Extinguishing media

**Suitable extinguishing agents** Product is not flammable. Use fire-fighting measures that suit the surrounding fire.

**For safety reasons unsuitable extinguishing agents** Water

### Special hazards arising from the substance or mixture

If this product is involved in a fire, the following can be released:

Gallium oxide

### Advice for firefighters

#### Protective equipment:

Wear self-contained respirator.

Wear fully protective impervious suit.

## 6 Accidental release measures

### Personal precautions, protective equipment and emergency procedures

Wear protective equipment. Keep unprotected persons away.

Ensure adequate ventilation

**Environmental precautions:** Do not allow material to be released to the environment without proper governmental permits.

**Methods and material for containment and cleaning up:** Pick up mechanically.

**Prevention of secondary hazards:** No special measures required.

### Reference to other sections

See Section 7 for information on safe handling

See Section 8 for information on personal protection equipment.

See Section 13 for disposal information.

## 7 Handling and storage

### Handling

#### Precautions for safe handling

Keep container tightly sealed.

Ensure good ventilation at the workplace.

**Information about protection against explosions and fires:** The product is not flammable

#### Conditions for safe storage, including any incompatibilities

### Storage

**Requirements to be met by storerooms and receptacles:** Refrigerate

**Information about storage in one common storage facility:**

Do not store together with oxidizing and acidic materials.

Protect from heat.

Store away from aluminum, aluminum alloys

Do not store together with acids.

Store away from strong bases.

Store away from oxidizing agents.

Store away from halogens.

Store away from magnesium/magnesium alloys

Store away from metals.

**Further information about storage conditions:**

Keep container tightly sealed.

Refrigerate

**Specific end use(s)** No further relevant information available.

## 8 Exposure controls/personal protection

### Additional information about design of technical systems:

Properly operating chemical fume hood designed for hazardous chemicals and having an average face velocity of at least 100 feet per minute.

### Control parameters

#### Components with limit values that require monitoring at the workplace:

The product does not contain any relevant quantities of materials with critical values that have to be monitored at the workplace.

**Additional information:** No data

### Exposure controls

#### Personal protective equipment

#### General protective and hygienic measures

The usual precautionary measures for handling chemicals should be followed.

Keep away from foodstuffs, beverages and feed.

Remove all soiled and contaminated clothing immediately.

Wash hands before breaks and at the end of work.

Maintain an ergonomically appropriate working environment.

**Breathing equipment:** Use suitable respirator when high concentrations are present.

#### Recommended filter device for short term use:

Use a respirator with type N95 (USA) or PE (EN 143) cartridges as a backup to engineering controls. Risk assessment should be performed to determine if air-purifying respirators are appropriate. Only use equipment tested and approved under appropriate government standards.

#### Protection of hands:

Impervious gloves

Check protective gloves prior to each use for their proper condition.

The selection of suitable gloves not only depends on the material, but also on quality. Quality will vary from manufacturer to manufacturer.

**Material of gloves** Nitrile rubber, NBR

**Penetration time of glove material (in minutes)** 480

**Glove thickness** 0.11 mm

**Eye protection:** Safety glasses

**Body protection:** Protective work clothing.

## 9 Physical and chemical properties

### Information on basic physical and chemical properties

#### General Information

#### Appearance:

**Form:** Low melting solid

**Color:** Silver grey

**Odor:** Odorless

**Odor threshold:** Not determined.

**pH-value:** Not applicable.

(Contd. on page 3)  
USA

**Product name: Gallium pellets**

(Contd. of page 2)

**Change in condition**  
**Melting point/Melting range:** 29.8 °C (86 °F)  
**Boiling point/Boiling range:** 2403 °C (4357 °F)  
**Sublimation temperature / start:** Not determined  
**Flammability (solid, gaseous)** Not determined.  
**Ignition temperature:** Not determined  
**Decomposition temperature:** Not determined  
**Auto igniting:** Not determined.

**Danger of explosion:** Not determined.  
**Explosion limits:**  
**Lower:** Not determined  
**Upper:** Not determined  
**Vapor pressure:** Not applicable.  
**Density at 20 °C (68 °F):** 5.91 g/cm<sup>3</sup> (49.319 lbs/gal)  
**Relative density** Not determined.  
**Vapor density** Not applicable.  
**Evaporation rate** Not applicable.  
**Solubility in / Miscibility with**  
**Water:** Insoluble  
**Partition coefficient (n-octanol/water):** Not determined.  
**Viscosity:**  
**dynamic:** Not applicable.  
**kinematic:** Not applicable.  
**Other information** No further relevant information available.

**10 Stability and reactivity**

**Reactivity** No information known.  
**Chemical stability** Stable under recommended storage conditions.  
**Thermal decomposition / conditions to be avoided:** Decomposition will not occur if used and stored according to specifications.  
**Possibility of hazardous reactions**  
 Corrodes aluminum  
 Reacts with strong oxidizing agents  
**Conditions to avoid** No further relevant information available.  
**Incompatible materials:**  
 Acids  
 Oxidizing agents  
 Halogens  
 Aluminum/aluminum alloys.  
 Magnesium/magnesium alloys  
 Metals  
 Bases  
 Heat  
**Hazardous decomposition products:** Gallium oxide

**11 Toxicological information**

**Information on toxicological effects**  
**Acute toxicity:** No effects known.  
**LD/LC50 values that are relevant for classification:** No data  
**Skin irritation or corrosion:** Product is not corrosive to the skin.  
**Eye irritation or corrosion:** Product is not corrosive to the eyes.  
**Sensitization:** No sensitizing effects known.  
**Germ cell mutagenicity:** The Registry of Toxic Effects of Chemical Substances (RTECS) contains mutation data for this substance.  
**Carcinogenicity:** No classification data on carcinogenic properties of this material is available from the EPA, IARC, NTP, OSHA or ACGIH.  
**Reproductive toxicity:** No effects known.  
**Specific target organ system toxicity - repeated exposure:** No effects known.  
**Specific target organ system toxicity - single exposure:** No effects known.  
**Aspiration hazard:** No effects known.  
**Subacute to chronic toxicity:** No effects known.  
**Additional toxicological information:** To the best of our knowledge the acute and chronic toxicity of this substance is not fully known.  
**Carcinogenic categories**  
**OSHA-Ca (Occupational Safety & Health Administration)** Substance is not listed.

**12 Ecological information**

**Toxicity**  
**Aquatic toxicity:** No further relevant information available.  
**Persistence and degradability** No further relevant information available.  
**Bioaccumulative potential** No further relevant information available.  
**Mobility in soil** No further relevant information available.  
**Additional ecological information:**  
**General notes:**  
 Do not allow material to be released to the environment without proper governmental permits.  
 Avoid transfer into the environment.  
**Results of PBT and vPvB assessment**  
**PBT:** Not applicable.  
**vPvB:** Not applicable.  
**Other adverse effects** No further relevant information available.

**13 Disposal considerations**

**Waste treatment methods**  
**Recommendation** Consult state, local or national regulations to ensure proper disposal.  
**Uncleaned packagings:**  
**Recommendation:** Disposal must be made according to official regulations.

**14 Transport information**

**UN-Number**  
**DOT, IMDG, IATA** UN2803

(Contd. on page 4)  
USA

Product name: **Gallium pellets**

(Contd. of page 3)

UN proper shipping name

DOT  
IMDG, IATA

Gallium  
GALLIUM

Transport hazard class(es)

DOT  
  
Class Label  
Class Label  
Class Label  
IMDG, IATA

8 Corrosive substances.  
8  
8 (C10) Corrosive substances  
8

  
Class Label  
8 Corrosive substances.  
8

Packing group  
DOT, IMDG, IATA

III

Environmental hazards:

Not applicable.

Special precautions for user

Warning: Corrosive substances

EMS Number:

F-A,S-B

Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code Not applicable.

Transport/Additional information:

DOT  
Marine Pollutant (DOT):

No

UN "Model Regulation":

UN2803, Gallium, 8, III

## 15 Regulatory information

**Safety, health and environmental regulations/legislation specific for the substance or mixture**  
**GHS label elements** The product is classified and labeled in accordance with 29 CFR 1910 (OSHA HCS)  
**Hazard pictograms**



GHS05

**Signal word** Warning

**Hazard statements**

H290 May be corrosive to metals.

**Precautionary statements**

P234 Keep only in original container.

P390 Absorb spillage to prevent material damage.

P406 Store in corrosive resistant container with a resistant inner liner.

**National regulations**

All components of this product are listed in the U.S. Environmental Protection Agency Toxic Substances Control Act Chemical substance Inventory.

All components of this product are listed on the Canadian Domestic Substances List (DSL).

**SARA Section 313 (specific toxic chemical listings)** Substance is not listed.

**California Proposition 65**

**Prop 65 - Chemicals known to cause cancer** Substance is not listed.

**Prop 65 - Developmental toxicity** Substance is not listed.

**Prop 65 - Developmental toxicity, female** Substance is not listed.

**Prop 65 - Developmental toxicity, male** Substance is not listed.

**Information about limitation of use:** For use only by technically qualified individuals.

**Other regulations, limitations and prohibitive regulations**

**Substance of Very High Concern (SVHC) according to the REACH Regulations (EC) No. 1907/2006.** Substance is not listed.

**The conditions of restrictions according to Article 67 and Annex XVII of the Regulation (EC) No 1907/2006 (REACH) for the manufacturing, placing on the market and use must be observed.**

Substance is not listed.

**Annex XIV of the REACH Regulations (requiring Authorisation for use)** Substance is not listed.

**Chemical safety assessment:** A Chemical Safety Assessment has not been carried out.

## 16 Other information

Employers should use this information only as a supplement to other information gathered by them, and should make independent judgement of suitability of this information to ensure proper use and protect the health and safety of employees. This information is furnished without warranty, and any use of the product not in conformance with this Material Safety Data Sheet, or in combination with any other product or process, is the responsibility of the user.

**Department issuing SDS:** Global Marketing Department

**Date of preparation / last revision** 02/18/2016 / -

**Abbreviations and acronyms:**

RID: Règlement international concernant le transport des marchandises dangereuses par chemin de fer (Regulations Concerning the International Transport of Dangerous Goods by Rail)

ICAO: International Civil Aviation Organization

ADR: Accord européen sur le transport des marchandises dangereuses par Route (European Agreement concerning the International Carriage of Dangerous Goods by Road)

IMDG: International Maritime Code for Dangerous Goods

DOT: US Department of Transportation

IATA: International Air Transport Association

EINECS: European Inventory of Existing Commercial Chemical Substances

CAS: Chemical Abstracts Service (division of the American Chemical Society)

HMIS: Hazardous Materials Identification System (USA)

WHMIS: Workplace Hazardous Materials Information System (Canada)

LC50: Lethal concentration, 50 percent

LD50: Lethal dose, 50 percent

vPvB: very Persistent and very Bioaccumulative

ACGIH: American Conference of Governmental Industrial Hygienists (USA)

OSHA: Occupational Safety and Health Administration (USA)

NTP: National Toxicology Program (USA)

IARC: International Agency for Research on Cancer

EPA: Environmental Protection Agency (USA)

Met. Corr.1: Corrosive to metals, Hazard Category 1