



Safety Data Sheet Magnetocaloric Materials

1. PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: Magnetocaloric Materials, Alloys of $Gd_xNd_yCe_{1-x-y}Si_{0.8}Cr_zMn_{0.2-z}$
COMMON SYNONYMS: Magnetocaloric Materials, Gd-base alloys, Nd-based alloys, Ce-based alloys
CHEMICAL FAMILY: Gadolinium, Neodymium, Cerium
FORMULA: $Gd_xNd_yCe_{1-x-y}Si_{0.8}Cr_zMn_{0.2-z}$ where $x+y \leq 1$, $z \leq 0.2$

Identified uses: Laboratory chemical, Magnetic Refrigeration Systems

Supplier: General Engineering & Research, L.L.C.
10459 Roselle St. Ste. A
San Diego, CA 92121-1527

Information: 858-291-8336

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Substances and mixtures, which in contact with water, emit flammable gases (Category 3), H261

Flammable solids (Category 1), H228

Acute aquatic toxicity (Category 2), H401

Skin irritation (Category 2), H315

Eye irritation (Category 2A), H319

Specific target organ toxicity – single exposure (Category 3), Respiratory system, H335

For the full text of the H-Statement mentioned in the Section, see Section 16.

2.2 GHS Label elements, including precautionary statements



Pictogram

Signal word Danger

Hazard statement(s)

H228 Flammable solid.

H261 In contact with water releases flammable gases

H302 + H312 + H332 Harmful if swallowed, in contact with skin or if inhaled.

H315 Causes skin irritation.

H319 Causes serious eye irritation.



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H335 May cause respiratory irritation.

Precautionary statement(s)

- P210 Keep away from heat/sparks/open flames/hot surfaces. No smoking.
P240 Ground/bond container and receiving equipment.
P241 Use explosion proof electrical/ventilating/lighting/equipment.
P261 Avoid breathing dust/fume/gas/mist/vapours/spray.
P264 Wash skin thoroughly after handling.
P271 Use only outdoors or in a well ventilated area.
P280 Wear protective gloves/protective clothing/ eye protection/ face protection.
P302 + P352 IF ON SKIN: Wash with plenty of soap and water.
P304 + P340 IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P305 + P351 + P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P312 Call a POISON CENTER or doctor/physician if you feel unwell.
P332 Get medical advice/ attention if you feel unwell.
P410 Toxic to aquatic life.
P402 + P404 Store in a dry place. Store in a closed container.
P501 Dispose of contents/container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION / INFORMATION ON INGREDIENTS

| <u>Component</u> | <u>Cas-No.</u> | <u>Concentration</u> |
|------------------|----------------|----------------------|
| Gadolinium | 7440-54-2 | 0 - 85.0% |
| Neodymium | 7440-00-8 | 0 - 85.0% |
| Cerium | 7440-45-1 | 0 – 85.0% |
| Silicon | 7440-21-3 | 5 – 15.0% |
| Chromium | 7440-47-3 | 0 – 5.0% |
| Manganese | 7439-96-5 | 0 – 5.0% |

Appearance

| | |
|--------|----------------------|
| Form | Solid |
| Colour | Silver/grey metallic |
| Odour | none |



3.1 Substances

| Formula | Molecular weight (g/mol) | CAS-No. |
|---------|--------------------------|-----------|
| Gd | 157.25 | 7440-54-2 |
| Nd | 144.24 | 7440-00-8 |
| Ce | 140.12 | 7440-45-1 |
| Si | 28.09 | 7440-21-3 |
| Cr | 52.00 | 7440-47-3 |
| Mn | 54.94 | 7439-96-5 |

| Hazardous Component | Classification | Concentration |
|----------------------------|---|----------------------|
| Gadolinium | Water-react. 3: H261 Skin irrit. 2; Eye Irrit. 2A; STOT SE 3; H315, H319 | 0 to 85% |
| Neodymium | H335 Flam. Sol. 1; Skin Irrit. 2; Eye Irrit. 2A; STOT SE 3; H228, H302 + H312 + H332, H315, H319, | 0 to 85% |
| Cerium | H335 | 0 to 85% |
| Manganese | Aquatic Acute 2; H401 | 0 to 5% |

For the full text of H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance.
Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Flush eyes with water as a precaution.

If swallowed

Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.



4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in Section 2.

4.3 Indication of any immediate medical attention and special treatment needed

No data available

5. FIRE-FIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media

Alcohol-resistant foam, dry chemical or carbon dioxide.

Unsuitable extinguishing media

Water

5.2 Special hazards arising from the substance or mixture

gadolinium oxides, neodymium oxides, cerium oxides

5.3 Advice for firefighters

Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information

No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. Avoid dust formation. Avoid breathing vapours, mist or gas. Avoid breathing dust. For personal protection see section 8.

6.2 Environmental precautions

Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up

Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE

Handling



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Keep away from sources of ignition. No smoking. Use only well ventilated areas. Avoid contact with eyes. Avoid contact with skin, inhalation and ingestion. Avoid breathing vapor. Avoid breathing dust. Keep away from children.

Storage

Storage conditions: Keep container tightly closed in a dry and well-ventilated place. Never allow product to get in contact with water during storage.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Exposure limits(s)

Contains no substances with occupational exposure limit values.

Exposure limits are listed below, if they exist.

| Component | CAS-No. | Value | Control parameters | Basis |
|-----------|-----------|---|-----------------------|---|
| Silicon | 7440-21-3 | TWA | 15 mg/m ³ | USA. Occupational Exposure Limits (OSHA) – Table Z-1 Limits for Air Contaminants |
| | | TWA | 5 mg/m ³ | USA. NIOSH Recommended Exposure Limits |
| | | PEL | 10 mg/m ³ | California permissible exposure limits for chemical contaminants (Title 8, Article 107) |
| | | Does not occur free in nature, but is found in silicon dioxide (silica) & in various silicates. | | |
| Chromium | 7440-47-3 | TWA | 1 mg/m ³ | USA. Occupational Exposure Limits (OSHA) – Table Z-1 Limits for Air Contaminants |
| | | TWA | 0.5 mg/m ³ | USA. ACGIH Threshold Limit Values (TLV) |
| | | PEL | 0.5 mg/m ³ | California permissible exposure limits for chemical contaminants (Title 8, Article 107) |
| Manganese | 7439-96-5 | TWA | 0.2 mg/m ³ | USA. ACGIH Threshold Limit Values (TLV) |
| | | C | 5 mg/m ³ | USA. Occupational Exposure Limits (OSHA) – Table Z-1 Limits for Air Contaminants |
| | | PEL | 0.2 mg/m ³ | California permissible exposure limits for chemical contaminants (Title 8, Article 107) |

Eye protection: Safety glasses or Goggles

Hand protection: Handle with gloves. Nitrile rubber gloves. Other chemical resistant gloves may be recommended by your safety professional.



Skin and body protection: Normal work wear.

Respiratory protection: No personal respiratory protective equipment normally required. The specific respirator selected must be based on the airborne concentration found in the workplace and must not exceed the working limits of the respirator.

Engineering measures: Engineering methods to prevent or control exposure are preferred. Methods include process or personnel enclosure, mechanical ventilation (local exhaust), and control of process conditions.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance

| | |
|--------------------------------|-------------------|
| Form | Ingots |
| Colour | light grey |
| Odour | none |
| pH | not applicable |
| Melting point/range | 1000C-1500C |
| Flash point | not applicable |
| Relative vapour density | no data available |
| Water solubility | no data available |
| Relative density | no data available |
| Evaporation rate | no data available |
| VOC's | no data available |

Note: The physical data presented above are typical values and should not be construed as a specification.

10. STABILITY AND REACTIVITY

| | |
|---|--|
| Hazardous reactions | Stable under recommended storage conditions |
| Conditions to avoid | exposure to water |
| Materials to avoid | water |
| Hazardous decomposition Products | gadolinium oxides, neodymium oxides, cerium oxides |
| Polymerization | Will not occur. |



11. TOXICOLOGICAL INFORMATION

Toxicological information on this product or its components appear in this section when such data is available.

Acute oral toxicity

Inhalation: No data available

Dermal: No data available

Skin corrosion/irritation

No data available

Serious eye damage/eye irritation

No data available

Respiratory or skin sensitisation

No data available

Carcinogenicity

Carcinogenicity - mouse – Implant

Tumorigenic: Equivocal tumorigenic agent by RTECS criteria. Tumorigenic: Tumors at site or application.

IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

No data available

Specific target organ toxicity - single exposure

Inhalation – May cause respiratory irritation

Specific target organ toxicity - repeated exposure

No data available

Aspiration hazard

No data available



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Additional Information

RTECS: AO8575000

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

12. ECOLOGICAL INFORMATION

Ecotoxicological information on this product or its components appear in this section when such data is available.

13. DISPOSAL CONSIDERATIONS

Environmental precautions: Prevent the material from entering drains or water courses. Advise Authorities if spillage has entered watercourse or sewer or has contaminated soil or vegetation.

Disposal

Dispose in accordance with all local, state (provincial), and federal regulations. Under RCRA, it is the responsibility of the product's user to determine at the time of disposal, whether the product meets RCRA criteria for hazardous waste. This is because the product uses, transformations, mixtures, processes, etc. may render the resulting materials hazardous.

Do not remove label until container is thoroughly cleaned. Empty containers may contain hazardous residues. This material and its container must be disposed of in a safe way.

14. TRANSPORT INFORMATION

DOT(US)

UN number; 3208 Class: 4.3 Packing group: III

Proper shipping name: Metallic substance, water-reactive, n.o.s. (Gadolinium)

Marine pollutant: No

Poison inhalation Hazard: No

IMDG/ IATA

UN number; 3208 Class: 4.3 Packing group: III EMS-No: F-G, S-N

Proper shipping name: Metallic substance, water-reactive, n.o.s. (Gadolinium)

Marine pollutant: No

Transportation classifications may vary by container volume and may be influenced by regional or country variations in regulations.

15. REGULATORY INFORMATION



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SARA 302 Components

SARA 302: No chemicals in this material are subject to the reporting requirements of SARA TITLE III: Section 302.

SARA 313 Components

The following components are subject to reporting levels established by SARA Title III, Section 313:

| | |
|-----------|-------------------|
| Chromium | CAS-No: 7440-47-3 |
| Manganese | CAS-No: 7439-96-5 |

SARA 311/312 Hazards

Reactivity Hazard
Acute Health Hazard
Chronic Health Hazard

Massachusetts Right To Know Components

| | |
|-----------|-------------------|
| Chromium | CAS-No: 7440-47-3 |
| Manganese | CAS-No: 7439-96-5 |

Pennsylvania Right To Know Components

| | |
|------------|-------------------|
| Gadolinium | CAS-No: 7440-54-2 |
| Neodymium | CAS-No: 7440-00-8 |
| Cerium | CAS-No: 7440-45-1 |
| Silicon | CAS-No: 7440-21-3 |
| Chromium | CAS-No: 7440-47-3 |
| Manganese | CAS-No: 7439-96-5 |

New Jersey Right To Know Components

| | |
|------------|-------------------|
| Gadolinium | CAS-No: 7440-54-2 |
| Neodymium | CAS-No: 7440-00-8 |
| Cerium | CAS-No: 7440-45-1 |
| Silicon | CAS-No: 7440-21-3 |
| Chromium | CAS-No: 7440-47-3 |
| Manganese | CAS-No: 7439-96-5 |

California (Proposition 65)

This product does not contain materials which the State of California has found to cause cancer, birth defects or other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

| | |
|---------------|------------------------|
| Acute Tox. | Acute Toxicity |
| Flam. Sol. | Flammable Solids |
| Eye Irrit. | Eye irritation |
| Aquatic Acute | Acute aquatic toxicity |
| Skin Irrit. | Skin irritation |



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Water-react. Substances and mixtures, which in contact with water, emit flammable gases.
STOT SE Specific target organ toxicity – single exposure
H228 Flammable solid
H261 In contact with water releases flammable gases.
H302 Harmful if swallowed
H302+H312+H332 Harmful if swallowed, in contact with skin or inhaled
H312 Harmful in contact with skin
H315 Causes skin irritation
H319 Causes serious eye irritation
H335 May cause respiratory irritation
H401 Toxic to aquatic life

Hazard Rating

| | Health | Chronic Health Hazard | Fire | Reactivity |
|--------------------|---------------|------------------------------|-------------|-------------------|
| HMIS Rating | 2 | - | 3 | 1 |
| NFPA Rating | 2 | | 3 | 1 |

Legend

| | |
|-------|---|
| ACGIH | American Conference of Governmental Industrial Hygienists |
| OSHA | Occupational Safety and Health Administration |
| PEL | Permissible Exposure Limit |
| STEL | Short Term Exposure Limit |
| TLV | Threshold Limit Value |
| TWA | Time Weighted Average |

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.