SAFETY DATA SHEET

SECTION 1 – CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Identifier: Faraday Rotator EMF
Product name: Substituted rare-earth Iron Garnet single crystals (RIG)
Manufacturer / Supplier: GRANOPT Co., Ltd
Address: 4-4 Ougibuchi, Aza, Ougida, Noshiro-shi, Akita 016-0122, Japan
Division: quality assurance group
Phone: +81-185-70-1800
Fax: +81-185-70-1803

SECTION 2 – HAZARDS IDENTIFICATION

GHS Classification

Health hazards
- Germ cell mutagenicity / Category2
- Carcinogenicity / Category2
- Reproductive toxicity / Category1A
- Specific target organ · Systemic toxicity / Category
- Serious eye damage · Eye irritation / Category 1
- Specific target organs / systemic toxicity
- Respiratory system / Category 1 Repeated
- Specific target organs / systemic toxicity Category 3 (airway severe) Single exposure
- Specific target organs / systemic toxicity Category 1 (respiratory system) Repeated exposure

Environmental hazard: Aquatic environment Chronic hazards / Category 4

Precautionary statements

【Prevention】
- Keep container tightle closed. (P233)
- Wash hands thoroughly after handling. (P264)
- Do not eat, drink or smoke when using this product. (P270)
**SECTION 3 – COMPOSITION/INFORMATION ON INGREDIENTS**

**Classification of the substance or mixture**
**Mixture**

**Composition table**

<table>
<thead>
<tr>
<th>Chemical name or generic name</th>
<th>Concentration or Concentration range</th>
<th>Chemical property</th>
<th>Reference number in gazetted list in Japan</th>
<th>CAS No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diiron trioxide (3)</td>
<td>32%</td>
<td>Fe2O3</td>
<td>METI No. (ENCNS No.) (1)-357,(5)-5188</td>
<td>Existing 1309-37-1</td>
</tr>
<tr>
<td>Bismuth oxide</td>
<td>59%</td>
<td>Bi2O3</td>
<td>(1)-98</td>
<td>Existing 1304-76-3</td>
</tr>
<tr>
<td>Rare-earth oxide</td>
<td>9%</td>
<td>R2O3</td>
<td>Proprietary</td>
<td></td>
</tr>
<tr>
<td>Gallium oxide</td>
<td>9%</td>
<td>Ga2O3</td>
<td>(1)-695</td>
<td>Existing 12024-21-4</td>
</tr>
</tbody>
</table>

Impurity and stabilization additive of contributing to a classification: No information available.

The Industrial Safety and Health Law

Dangerous and Toxic Diiron trioxide (Ordinance No.: 192) (32%)

The product is classified as a mixture, but it is equivalent to a single compound which consists of compounds listed in the component table. The

<table>
<thead>
<tr>
<th>Response</th>
<th>Storage</th>
<th>Disposal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use only outdoors or in a well-ventilated area. (P271) Wear protective gloves. (P280) Wear eye protection/face protection. (P280) IF ON SKIN: Gently wash with plenty of soap and water. (P302+P352) IF INHALED: Remove to fresh air and keep at rest in a position comfortable for breathing. (P304+P340) IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. (P305+P351+P338) Immediately call a POISON CENTER or doctor/physician. (P310) Call a POISON CENTER or doctor/physician if you feel unwell. (P312) If skin irritation occurs: Get medical advice/attention. (P332+P313) Take off contaminated clothing and wash before re-use. (P362)</td>
<td>Store at normal temperatures and normal humidity.</td>
<td>Dispose of contents and container in accordance with all local, regional, national and international regulations. (P501)</td>
</tr>
</tbody>
</table>
SECTION 4–FIRST AID MEASURES

Inhalation
Remove to fresh air and keep at rest in a position comfortable for breathing.
Call a POISON CENTER or doctor/physician.

Skin contact
Wash contaminated clothing before reuse.
Call a POISON CENTER or doctor/physician if you feel unwell.
Wash with soap and water.
Remove/Take off immediately all contaminated clothing.

Eyes contact
Rinse cautiously with water for several minutes.
Remove contact lenses, if present and easy to do.
Continue rinsing.
Call a POISON CENTER or doctor/physician.

Ingestion
Rinse mouth.
Call a POISON CENTER or doctor/physician if you feel unwell.

SECTION 5–FIRE FIGHTING MEASURES

Suitable extinguishing media
No information available.

Special protective equipment and precautions for fire-fighters
Wear proper protection Use Self-Contained Breathing Apparatus (SCBA), chemical protective clothing.

SECTION 6–ACCIDENTAL RELEASE MEASURES

Personal precautions:
Handling person should wear suitable protective equipment as indicated in section 8. Avoid contact with eye or skin. Avoid breathing gas.

Collection and neutralization
Vacuum up or sweep up spillage and collect in suitable container for disposal.
Absorb the leakage with inert material (e.g. dry sand, soil, etc.,) and collect in a container for disposal of chemical product.
Scoop up or use appropriate absorber to remove from the water surface. Do not use dispersant.
Substance is to solidify and gather up after eliminating, clean completely contaminated area with water.

Methods and materials for containment and cleaning up

SECTION 7–HANDLING AND STORAGE

Handling
Take equipment measures and wear suitable protective equipment as indicated in section 8 (EXPOSURE CONTROL/PERSNAL PROTECTION).

Technical measures
Use total or local exhaust ventilation as indicated in section 8 (EXPOSURE CONTROL/PERSNAL PROTECTION).

Total or local exhaust ventilation
SECTION 8–EXPOSURE CONTROL/PERSOMAL PROTECTION

Administrative level, Occupational exposure limits

<table>
<thead>
<tr>
<th></th>
<th>Administrative level</th>
<th>Japan Society for Occupational Health</th>
<th>ACGIH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diiron trioxide</td>
<td>Not established.</td>
<td>(Class 2 dust) Respirable dust 1mg/m³ Total dust 4mg/m³</td>
<td>TWA 5mg/m³ (R)</td>
</tr>
<tr>
<td>Bismuth trioxide</td>
<td>Not established.</td>
<td>(Class 3 dust) Respirable dust 2mg/m³ Total dust 8mg/m³</td>
<td>TWA 5mg/m³ (R)</td>
</tr>
<tr>
<td>Gallium oxide</td>
<td>3.0mg/m³</td>
<td>(Class 2 dust) Respirable dust 1mg/m³ Total dust 4mg/m³</td>
<td>TLV-TWA 3mg/m³(Respirable Dust) TLV-TWA 10mg/m³(Suction Dust)</td>
</tr>
</tbody>
</table>

Equipment measures

If dust or fume is produced in thermal process, install ventilating equipment to keep the atmospheric concentration of the air contaminant below the administrative level or allowable exposure limit.

Personal protection equipments

Respiratory protection: Wear suitable dust mask.
Hand protection: Wear suitable protective gloves.
Eye protection: Wear suitable eye protection.

Wash hands thoroughly after handling.

SECTION 9–PHYSICAL AND CHEMICAL PROPERTIES

As product

Physical state: Chip-like solid (Ambient temperature)
Melting point/freezing point: ca. 1,200°C
Relative weight (Density): 6.6(Ambient temperature)
Solubility: Soluble in strong acid and strong alkaline
Decomposition temperature: No data available
Boiling, Initial boiling point and Boiling range Not available
Flash point Not flash
Auto-ignition temperature Not available
pH No data available

As Diiron trioxide
Melting point/freezing point 1,550°C
Relative weight (Density) 5.1~5.2
Solubility slowly soluble in acid,Hard to soluble in acid (Strong heat substances)
Decomposition temperature 400~700°C(γ→α type conversion), Decomposition (oxide may be emitted) (Strong heat)

As Bismuth trioxide
Melting point/freezing point 820°C, 860°C
Boiling, Initial boiling point and Boiling range 1,900°C
Relative weight (Density) 8.9, 8.55
Solubility Insoluble in water, Soluble in strong acid
Decomposition temperature 704°C(Transition temperature)

As Gallium oxide
Melting point/freezing point ca. 1,900°C
Relative weight (Density) 6.0
Solubility Insoluble in water, Soluble in alkaline/heating acid

SECTION 10–STABILITY AND REACTIVITY
Stability Considered Stable under handling and storage at according to Law and regulations.
Possibility of hazardous reaction No data available
Condition to avoid No data available
Hazardous decomposition products No data available

SECTION 11–TOXICOLOGICAL INFORMATION
As product No information available.

As Diiron trioxide
Acute toxicity (oral) No data available
Acute toxicity (dermal) No data available
Acute toxicity (inhalation: gas) Classified as “solid” according to GHS definition.
Acute toxicity (inhalation: vapour) No data available
Acute toxicity (inhalation: dust) Since this product is solid form and most vapor pressures can be disregarded, it is thought that the inhalation study was done with the dust. Since there was no study in which LC50 value was acquired, data is insufficient and it cannot be classified.
Acute toxicity (inhalation: mist) Since this product is solid form and most vapor pressures can be disregarded, it is thought that the inhalation study was done with the dust. Since there was no study in which LC50 value was acquired, data is insufficient and it cannot be classified.
Skin corrosion / irritation
Serious eye damage / eye irritation
Respiratory/skin sensitizer
Germ cell mutagenicity
Carcinogenicity
Toxic to reproduction
Specific target organs/systemic toxicity following single exposure
Specific target organs/systemic toxicity following repeated exposure
Aspiration hazard

As Bismuth trioxide

Acute toxicity (oral)
Acute toxicity (dermal)
Acute toxicity (inhalation: gas)
Acute toxicity (inhalation: vapour)
Acute toxicity (inhalation: dust)
Acute toxicity (inhalation: mist)
Skin corrosion / irritation
Serious eye damage / eye irritation
Respiratory/skin sensitizer

Based on the description of redness and moderate irritation on humans (ICSC (J) (2004), IUCLID (2000)), it was classified as Category 2.

Based on the description with corrosive in humans (IUCLID (2000)), it was set as Category 1.

Respiratory: No data available, skin sensitizer: Classification not possible due to lack of data.

There were no in vivo test results and there was no strong positive finding of multiple indices for the in vitro test. Therefore we presupposed that we could not categorize it according to the technical guideline.

Based on being classified into A4 according to ACGIH, it carried out the outside of Category.

The coughing was seen in humans and it is classified into Category 3 (respiratory irritation) based on the publication that there is also closeness (ICSC (J), (2004), IUCLID (2000)).

There is the statement that although abnormalities are found on a chest x-rays test in humans, it is clinically satisfactory (ACGIH (2001)), and there is also a statement if it accumulates in a lungs, it will become siderosis, but it is benign and does not progress to fibrosis (ACGIH (2001)). Moreover, there is a statement that metal fevers may be occured by exposure (IUCLID (2000)) . Since the lung effects was seen inspite of being benign, and metal fevers might be affected, it was classified into Category 1 (respiratory systems).

No data available

Classification is not possible due to lack of data. A data of LD 50 = 4 mg /kg (RTECS (2007)) is available. "See other hazard data of bismuth compound as well."

Classified as “solid” according to GHS definition.

No data available

No data available

No data available

No data available

No data available

No data available

No data available

No data available
Germ cell mutagenicity
Carcinogenicity
Toxic to reproduction
Specific target
organs/systemic toxicity
following single exposure

A result is available that chromosome aberration including gap was observed in chromosome aberration study using mouse bone marrow by oral administration (somatic cell in vivo mutagenicity test) (PATTY (5th, 2009)). However, the detail is unknown and evaluation is not possible. Therefore, classification is not possible.

Carcinogenicity
Toxic to reproduction
Specific target
organs/systemic toxicity
following repeated exposure

It is described that encephalopathy, nephropathy, osteoarthritis, gingivitis, stomatitis, colitis are caused by bismuth and bismuth compounds as general toxic effect to human (skin sensitizer). In addition, there is a description that clinical symptoms in acute poisoning are similar to those caused by mercury and lead which include neurologic abnormality accompanied by encephalopathy, renal dysfunction accompanied by nephritic syndrome (PATTY (5th, 2001)). Based on these the product is classified into Category 1 (nervous system, kidney, articular).

Specific target
organs/systemic toxicity
following repeated exposure

It is described that encephalopathy, nephropathy, osteoarthritis, gingivitis, stomatitis, colitis, etc., are caused by bismuth and bismuth compounds as general toxic effect to human and that inorganic bismuth causes neurotoxicity (PATTY (5th, 2001)). Based on this, the product is classified into Category 1 (nervous system, articular, kidney). Also, there is a report that chronic toxicity such as anorexia nervosa, rheumatalgia, diarrhea, fever, halitosis, gingivitis, dermatitis were noted in human (HSDB (2002)).

Aspiration hazard

No data available

As Gallium oxide

Acute toxicity (oral)
Acute toxicity (dermal)
Acute toxicity (inhalation: gas)
Acute toxicity (inhalation: vapour)
Acute toxicity (inhalation: dust)
Acute toxicity (inhalation: mist)
Skin corrosion / irritation
Serious eye damage / eye irritation
Respiratory/skin
Germ cell mutagenicity
Carcinogenicity
Toxic to reproduction
Specific target
organs/systemic toxicity
following single exposure

No data available

No data available

Due to the fact that the substance is “solid” according to the GHS definition and inhalation of its gas is not expected.

No data available

No data available

No data available

No data available

No data available

No data available

No data available

No data available

No data available

No data available
Specific target organs/systemic toxicity following repeated exposure

SECTION 12–ECOLOGICAL INFORMATION
As product Environmental Hazards Ecotoxicity data No information available.
As Diiron trioxide Environmental Hazards Ecotoxicity data Hazardous to the aquatic environment (acute): Classification not possible due to lack of data
Hazardous to the aquatic environment (chronic): Classification not possible due to lack of data
As Bismuth trioxide Environmental Hazards Hazardous to the aquatic environment (acute): (unclassified)
Hazardous to the aquatic environment (chronic): (unclassified)
As Gallium oxide Environmental Hazards Ecotoxicity data No data available
As Litharge Environmental Hazards Hazardous to the aquatic environment (acute): Classification not possible due to lack of data
Hazardous to the aquatic environment (chronic): Since although acute toxicity is not reported within the aqueous solubility concentrations, it was a metallic compound, and the underwater action was unknown, it was classified into Category 4.

SECTION 13–DISPOSAL CONSIDERATIONS
Residual waste Lower hazard level as much as possible before disposal by detoxification, stabilization or neutralization processing.
Waste disposal should be in accordance with existing federal, state and local environmental control laws.
Entrust disposal to officially recognized expert traders or disposal dealers with the permission of the prefectural governor, or entrust to local public entities if they are dealing disposal.
Entrust disposal by notifying dangerous and hazardous information thoroughly to waste treatment company.
Waste material categorized as “Special designated hazardous industrial waste” of “Special Control Industrial Waste” should be disposed in accordance with applicable and related regulation.
Including contaminated containers and packaging

SECTION 14—TRANSPORT INFORMATION

<table>
<thead>
<tr>
<th>International regulations</th>
<th>Marine regulation</th>
<th>UN number</th>
<th>Not applicable</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Marine Pollutant</td>
<td>Not applicable</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Aviation regulation</td>
<td>Not applicable</td>
<td></td>
</tr>
<tr>
<td>Domestic regulation</td>
<td>UN number</td>
<td>Not applicable</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Land regulation information</td>
<td>Not applicable</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Marine regulation information</td>
<td>Not applicable</td>
<td></td>
</tr>
<tr>
<td></td>
<td>UN number</td>
<td>Not applicable</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Marine Pollutant</td>
<td>Not applicable</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Aviation regulation</td>
<td>Not applicable</td>
<td></td>
</tr>
</tbody>
</table>

SECTION 15—REGULATORY INFORMATION

<table>
<thead>
<tr>
<th>The Industrial Safety and Health Law</th>
<th>Dangerous and Toxic Substances Subject to Notify Their Names, etc. (law Article 57 1, enforcement order Article 18)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lead compound (enforcement order separate table fourth Ordinance on Prevention of Lead Poisoning Article 1 fourth, 47 昭 Department of Labor notification 91)</td>
</tr>
<tr>
<td></td>
<td>Dangerous and Toxic Substances Subject to Notify Their Names, etc. (2 of law Article 57 2 separate tables ninth of enforcement order Article 18)</td>
</tr>
<tr>
<td>Law concerning Pollutant Release and Transfer Register</td>
<td>Include compound (PbO) corresponding to Class I Designated Chemical Substances.</td>
</tr>
<tr>
<td>Poisonous and Deleterious Substances Control Act</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Directive RoHS</td>
<td>Restriction of the use of certain hazardous substances in electrical and electronic equipment.</td>
</tr>
<tr>
<td></td>
<td>Directive RoHS is not applicable for this product, but is based on directive RoHS.</td>
</tr>
</tbody>
</table>

SECTION 16—OTHER INFORMATION

| Risk assessment | Avoid direct release to the rivers, etc., landfill or disposal of the effluent and washing water containing this product. |
|                | Recycle used containers by cleaning or dispose appropriately in accordance with official regulation. Dispose of empty container after eliminating contents completely. |
The information in this SDS was obtained from current and reputable sources, data and information. However, composition content, physical and chemical property, danger and hazard information data are it may be updated based on the new scientific finding and test data etc., As cautions described are for normal usage, and it is assumed any chemical product has unknown hazard, extreme caution is required for handling. It is the user’s responsibility to determine safe conditions for use of this product. For special handling, please use it in the light of suitable safety measures for application and usage.