SAFETY DATA SHEET

SECTION 1 – CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Identifier: Faraday Rotator GTD, GLB
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
Phone: +81-185-70-1800
Fax: +81-185-70-1803

SECTION 2 – HAZARDS IDENTIFICATION

GHS Classification
Health hazards: Germ cell mutagenicity / Category 2
Carcinogenicity / Category 2
Reproductive toxicity / Category 1A
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
Hazards not stated here are “Not applicable” or “Classification not possible”.

Environmental hazard: Aquatic environment Chronic hazards / Category 4

GHS label
Symbols

Signal words
Hazard statements
H315 Causes skin irritation
H318 Causes serious eye damage
H335 May cause respiratory irritation
H370 Causes damage to organs (Nervous system, Kidney, osteoarticular)
H372 Causes damage to organs (respiratory system, Nervous system, Kidney, osteoarticular) through prolonged or repeated exposure

Precautionary statements
【Prevention】
Keep container tightly 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 (ENCS No.)</th>
<th>ISHL No.</th>
<th>CAS No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diiron trioxide (3)</td>
<td>39%</td>
<td>Fe2O3</td>
<td>(1)–357,(5)–5188</td>
<td>Existing</td>
<td>1309–37–1</td>
</tr>
<tr>
<td>Bismuth oxide</td>
<td>60.9%</td>
<td>Bi2O3</td>
<td>(1)–98</td>
<td>Existing</td>
<td>1304–76–3</td>
</tr>
<tr>
<td>Rare-earth oxide</td>
<td>0.1%</td>
<td>R2O3</td>
<td>Proprietary</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lead monoxide (2)</td>
<td>0.1%</td>
<td>PbO</td>
<td>(1)–527</td>
<td>Existing</td>
<td>1317–36–8</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 Substances Subject to Notify Their Names, etc. (Ordinance No.: 411)(0.1%) Lead and the inorganic compound (Ordinance No.: 192) (39%)

Information as the mixture

This product is classified as a mixture, but it is equivalent to a single compound which consists of compounds listed in the component table. The
product does not demonstrate properties which are inherent to each component on its own, or each component does not elute (from the product).

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.
Call a POISON CENTER or doctor/physician.

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
Technical measures
Take equipment measures and wear suitable protective equipment as indicated in section 8 (EXPOSURE CONTROL/PERSO

Total or local exhaust ventilation
Use total or local exhaust ventilation as indicated in section 8 (EXPOSURE CONTROL/PERSO

Precautions for safe handling
Avoid contact with eyes and skin.
Do not eat, drink or smoke when using this product.
SECTION 8–EXPOSURE CONTROL/PERSONAL 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>As product</td>
<td>No information available.</td>
<td>No information available.</td>
<td>No information available.</td>
</tr>
<tr>
<td>Diiron trioxide</td>
<td>Not established.</td>
<td>Dust occupational exposure limits (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></td>
<td></td>
</tr>
<tr>
<td>Litharge</td>
<td>0.05mg/m3(As Pb)</td>
<td>0.1mg/m3(As Pb, excluding alkylled lead compound)</td>
<td>TWA 0.05mg/m3 (As Pb)</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.

Specific Hygiene Measures
Wash hands thoroughly after handling.

SECTION 9–PHYSICAL AND CHEMICAL PROPERTIES

As product:
Physical state
Melting point/freezing point
Relative weight (Density)
Solubility
Decomposition temperature
Boiling point and Boiling range
Flash point

Physical Form
Chip-like solid ( Ambient temperature )
ca. 1,200°C
6.6(Ambient temperature)
Soluble in strong acid and strong alkaline
No data available
Not available
Not flash
### 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**: Based on the description of redness and moderate irritation on humans (ICSC (J) (2004), IUCLID (2000)), it was classified as Category 2.
Serious eye damage / eye irritation  | Based on the description with corrosive in humans (IUCLID (2000)), it was set as Category 1.
Respiratory/skin sensitizers  | Respiratory: No data available, skin sensitizer: Classification not possible due to lack of data.
Germ cell mutagenicity  | 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.

Carcinogenicity  | Based on being classified into A4 according to ACGIH, it carried out the outside of Category.
Toxic to reproduction  | No data available
Specific target organs/systemic toxicity following single exposure  | 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)).
Specific target organs/systemic toxicity following repeated exposure  | 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).

Aspiration hazard  | No data available

As Bismuth trioxide
Acute toxicity (oral)  | 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.”
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)  | No data available
Acute toxicity (inhalation: mist)  | No data available
Skin corrosion / irritation  | No data available
Serious eye damage / eye irritation  | No data available
Respiratory/skin sensitizers  | Respiratory: No data available, skin sensitizer: No data available
Germ cell mutagenicity
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
No data available
Specific target
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 Litharge
Acute toxicity (oral)
No data available
Acute toxicity (dermal)
No data available
Acute toxicity (inhalation: gas)
Due to the fact that the substance is “solid” according to the GHS definition and inhalation of its gas is not expected.

Acute toxicity (inhalation: vapour)
No data available
Acute toxicity (inhalation: dust)
No data available
Acute toxicity (inhalation: mist)
No data available

Skin corrosion / irritation
Based on the description in the report on rabbit skin irritation tests (CERI Hazard Data 2001–9 (2002)) “mild irritation”. It was classified as Category 3. Refer to other data on lead and its compounds (primarily inorganic lead)

Serious eye damage / eye irritation
No data available
Refer to other data on lead and its compounds (primarily inorganic lead)
| **Respiratory/skin sensitizer** | Respiratory sensitizer: No data available  
Refer to other data on lead and its compounds (primarily inorganic lead)  
Skin sensitizer: No data available  
Refer to other data on lead and its compounds (primarily inorganic lead) |
<table>
<thead>
<tr>
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<th></th>
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</thead>
<tbody>
<tr>
<td><strong>Germ cell mutagenicity</strong></td>
<td>Based on many reports on the occupational exposure to lead compounds and the results of epidemiological studies: lead compounds induce chromosome aberration and micronucleated cells in human peripheral blood cells (SCE formation is also observed). Although no data are available on the evaluation of lead oxides per se, the results of epidemiological studies should be taken into account in view of their human germ cell mutagenicity. However, classification may not be possible, if based on the description in IARC 23 (1980): data on multi-generation mutagenicity tests, germ/somatic cell mutagenicity tests in vivo and germ/somatic cell genotoxicity tests in vivo are not available, and in vitro mutagenicity tests do not show strong positive results (in several indexes). It was classified as Category 2.</td>
</tr>
<tr>
<td><strong>Carcinogenicity</strong></td>
<td>Category 2, Based on the classification by NTP (2005) (R: Lead and Lead Compounds), IARC (1987) (Group 2B: Lead and Inorganic Lead Compounds) and the Japan Society of Occupational Health (2B: Lead Compounds (Inorganic). It was classified as Category 2.</td>
</tr>
<tr>
<td><strong>Toxic to reproduction</strong></td>
<td>Based on the description in IARC 23 (1980): The results of epidemiological studies conducted at lead smelters suggest a significant increase in spontaneous abortion rates. It was classified as Category 1A. (Workers in lead smelters may be exposed to lead fume, which is probably lead monoxide.)</td>
</tr>
<tr>
<td><strong>Specific target organs/systemic toxicity</strong></td>
<td>No data available</td>
</tr>
<tr>
<td><strong>Specific target organs/systemic toxicity following repeated exposure</strong></td>
<td>Category 2, Based on human evidence including “the substance induces eye/skin/respiratory irritation and induces chemical bronchitis, pneumonia and pulmonary edema through inhalation of vapor” (ICSC (J) (2002)). It was classified as Category 2.</td>
</tr>
<tr>
<td><strong>Aspiration hazard</strong></td>
<td>No data available</td>
</tr>
</tbody>
</table>

**SECTION 12– ECOLOGICAL INFORMATION**

<table>
<thead>
<tr>
<th><strong>As product</strong></th>
<th>Environmental Hazards</th>
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</thead>
<tbody>
<tr>
<td></td>
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<tr>
<td>Ecotoxicity data</td>
<td>No information available.</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>As Diiron trioxide</strong></th>
<th>Environmental Hazards</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hazardous to the aquatic environment (acute): Classification not possible due to lack of data</td>
</tr>
</tbody>
</table>
As Bismuth trioxide

Environmental Hazards

Hazardous to the aquatic environment (acute): (unclassified)
Hazardous to the aquatic environment (chronic): (unclassified)

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.

Including contaminated containers and packaging

Recycle used containers by cleaning or dispose appropriately in accordance with official regulation.
Dispose of empty container after eliminating contents completely.

SECTION 14–TRANSPORT INFORMATION

International regulations

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

**SECTION 15—REGULATORY INFORMATION**

The Industrial Safety and Health Law

- Not applicable

Law concerning Pollutant Release and Transfer Register
- Not applicable

Poisonous and Deleterious Substances Control Act
- Not applicable

Directive RoHS

- Restriction of the use of certain hazardous substances in electrical and electronic equipment.

- Directive RoHS is not applicable for this product, but is based on directive RoHS.

**SECTION 16—OTHER INFORMATION**

**Risk assessment**

<table>
<thead>
<tr>
<th>Health</th>
<th>Fire</th>
<th>Reactivity</th>
<th>Personal Protection</th>
<th>Hazard assessment procedure</th>
<th>Reason for revision</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>0</td>
<td>0</td>
<td>-</td>
<td>HMIS</td>
<td>New SDS</td>
</tr>
<tr>
<td>0</td>
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<td>2</td>
<td>3~4</td>
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<td>0</td>
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<td>-</td>
<td></td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>-</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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.