MATERIAL SAFETY DATA SHEET

1. PRODUCT AND COMPANY IDENTIFICATION

Product name: SHOROX A (Rare earth oxide polishing compound)

Company name: SHOWA DENKO K.K.

Address: 1, Soga Shiojiri, Nagano 399-6461 Japan

Section: Marketing Department, Ceramics Division, Inorganic Sector

Telephone number: 81-263-52-1253

Facsimile number: 81-263-52-1271

Emergency telephone number: SHOWA DENKO K.K. Shiojiri Plant 81-263-52-0180

TOHOKU METAL CHEMICAL Co., Ltd. 81-246-34-2112

MSDS number: CE-3536

2. COMPOSITION / INFORMATION ON INGREDIENTS

Substance or mixture: Mixture

Common chemical name (generic name): Rare earth oxide

Content: Combined rare earth oxide levels are greater than 85%

Chemical formula:

<table>
<thead>
<tr>
<th>Substance</th>
<th>Chemical formula</th>
<th>CAS number</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>CeO₂</td>
<td>1306-38-3</td>
<td>45wt%</td>
<td></td>
</tr>
<tr>
<td>La₂O₃</td>
<td>1312-81-8</td>
<td>20wt%</td>
<td></td>
</tr>
<tr>
<td>Pr₆O₁₁</td>
<td>12037-29-5</td>
<td>Trade Secret</td>
<td></td>
</tr>
</tbody>
</table>

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<table>
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<tbody>
<tr>
<td>Nd₂O₃</td>
<td>1313-97-9</td>
<td>45wt%</td>
<td></td>
</tr>
<tr>
<td>CeF₃</td>
<td>7758-88-5</td>
<td>20wt%</td>
<td></td>
</tr>
<tr>
<td>LaF₃</td>
<td>13709-38-1</td>
<td>Trade Secret</td>
<td></td>
</tr>
</tbody>
</table>

3. HAZARDS IDENTIFICATION

Most important hazards: If caused to dust above the TLV or PEL limits, personal protective equipment is required. Read above ingredient limits. Prolonged overexposure to dusts may cause lung damage.

Adverse human health effects:

Inhalation: Breathing dust may result in irritation of the nose and throat, coughing, shortness of breath and bronchitis. Existing respirable disorders may be aggravated by exposure.

Skin: Not absorbed through skin. Dust may be abrasive and mildly irritating.

Eye: Dust may irritate eyes. Contact with dust or slurry may be abrasive and irritating causing tearing and redness.

Ingestion: All accidental ingestion of dust or slurry may cause irritation of the digestive tract.

Environmental effects: No date available

Specific hazards: Stable in the atmosphere

Classification of chemical product: Not applicable
4. FIRST-AID MEASURES
Inhalation : Remove immediately to fresh air.
Skin contact : Wash the affected area with soap and running water. If necessary, call a physician.
Eye contact : Flush eyes with clean running water for at least 15 minutes. If necessary, call a physician.
Ingestion : Vomit. If necessary, call a physician.

5. FIRE-FIGHTING MEASURES
Extinguishing media : Use water, foam, dry chemical, CO₂
Specific methods of fire-fighting and special equipment : This product is incombustible and stable, except the container.
Fire fighting instructions : Use sufficient local exhaust to reduce the dust.
Protection of firefighters : Use self-contained breathing apparatus to avoid dust or fumes generated during fire fighting efforts.

6. ACCIDENTAL RELEASE MEASURES
Personal precautions : Keep upwind of generated dusts during clean up.
Methods for cleaning up : Use dustless methods such as a vacuum and place into cosable container for disposal, or flush with water. Do not dry sweep. Flush spilled material into suitable retaining areas or containers with water to avoid airborne particulates.

7. HANDLING AND STORAGE
Handling
Safe handling advice : Wear long-sleeved working clothes, safety goggles, dust-proof mask and protective gloves to avoid eye and skin contact and breathing dust. Use in adequate ventilation.
Storage
Appropriate storage conditions : Avoid direct sunlight. Keep the container or paper bag tightly closed and store in a dry, cool, and well-ventilated place.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION
Engineering measures to reduce exposure : Handle with adequate local exhaust ventilation for nuisance dust. Install washstand and eye-flush equipment near the workshop.
Exposure guidelines :
Japan Society for Occupational Health (2005) : Inhalative particles 1 mg/m³
Total particles 4 mg/m³
ACGIH (2005) : PNOS* TLV-TWA 10 mg/m³ (E, I)
OSHA (2004) : PNOS* 3 mg/m³ (E, R)
(OSHA) : PNOS: Particulate Not Otherwise Specified
* PNOS: Particulate Not Otherwise Specified

Personal protective equipment
Respiratory protection : Dust-proof mask
Hand protection : Rubber gloves
Eye protection : Safety goggles
Skin and body protection : Long-sleeved working
9. PHYSICAL AND CHEMICAL PROPERTIES

Physical state
Appearance : Powder
Color : Brown
Odor : Odorless
pH : 7-11 (as 10wt% slurry by water)

Specific temperatures/temperature ranges at which changes in physical state
Melting point : 2,600 °C
Flash point : Not flashing
Explosion properties : Not explosion
Specific gravity : 6.2
Solubility
Water : Insoluble
Other solvents : Soluble in acid

10. STABILITY AND REACTIVITY

Stability : Stable in the atmosphere
Reactivity : Not show severe reaction in contact another material
Hazardous decomposition products : Will not occur

11. TOXICOLOGICAL INFORMATION

Toxicological Information of mixture
Acute toxicity : No date available
Local effects (skin, eye etc.) : May be irritating (We don’t have animal test)
Mutagenicity : No data available

Toxicological Information of CeO₂

Acute toxicity : Oral rat LD₅₀ >5000 mg/kg
                   Intraperitoneal mouse LD₅₀ 465 mg/kg
                   Inhalation rat TCL₀ 50 mg/m³/4H/17W (Intermittent)
               Lungs, Thorax, or Respiration : Fibrosis, Focal (Pneumoconiosis)
               Liver : Liver function tests impaired
               Biochemical : Enzyme inhibition, induction, or change in blood or tissue levels.
               TCL₀ 50 mg/m³/6H/90D (Intermittent)
               Lungs, Thorax, or Respiration : Structural or functional change in trachea or bronchi Lungs. Changes in lung weight.
               Blood : Other change.
               TCL₀ 100 mg/m³/2H/30D (Intermittent)
               Cardiac : EKG changes not diagnostic of specified effects.
               Lungs, Thorax, or Respiration : Other changes.
               Blood : Leukopenia.

Local effects (skin, eye etc.) : No data available
Mutagenicity : No data available
Toxicological Information of $La_2O_3$

**Acute toxicity**
- Oral rat $LD_{50} > 8500 \, mg/kg$ (La)
- Oral mouse $LD_{50} > 2450 \, mg/kg$ (La)
- Intraperitoneal mouse $LD_{50} 530 \, mg/kg$

**Local effects (skin, eye etc.)**
- Eye irritation (Rabbit) 100mg (Mild irritation)

**Mutagenicity**
- No data available

Toxicological Information of $PrO_1$

**Acute toxicity**
- Oral rat $LD_{50} > 5000 \, mg/kg$

**Local effects (skin, eye etc.)**
- No data available

**Mutagenicity**
- Cytogenetic analysis of intraperitoneal (mouse) 77 mg/kg

Toxicological Information of $Nd_2O_3$

**Acute toxicity**
- Oral rat $LD_{50} > 5000 \, mg/kg$

**Local effects (skin, eye etc.)**
- No data available

**Mutagenicity**
- Cytogenetic analysis of intraperitoneal (mouse) 86 mg/kg

Toxicological Information of $CeF_3$

**Acute toxicity**
- Oral rat $LD_{50} > 5000 \, mg/kg$

**Local effects (skin, eye etc.)**
- No data available

**Mutagenicity**
- No data available

### 12. ECOLOGICAL INFORMATION
No data available

### 13. DISPOSAL CONSIDERATIONS
Treat sludge as industrial waste. Standard waste water disposal methods consistent with applicable local, state and federal regulations.

When discharging empty containers, remove the contents completely before disposing of them.

Note: When disposing of the product outside Japan, conform to applied laws and regulations in that country or territory.

### 14. TRANSPORT INFORMATION

International regulations for transport

- **IMDG code**: Not applicable
- **ICAO-TI / IATA-DGR**: Not applicable
- **UN hazard class**: Not applicable
- **UN number**: Not applicable

Specific precautionary transport measures and conditions:

Before transport, make sure that there is no break in packaging and no leakage. Avoid spill, impact, fall or damage during loading and handle with care and prevent breakage of containers or bags.

Note: When transporting the product outside Japan, conform to applied laws and regulations in that country or territory.
15. REGULATORY INFORMATION

Laws and regulations applied in Japan:

- A powdered dust difficulty prevention rule
- Not include the harmful substances subject to the notification of the name etc. in The Industrial Safety and Health Law, Poisonous and Deleterious Substances Control Law and The Low Concerning and Reporting, etc. of Releases to the Environment of Specific Chemical Substances and Promoting Improvements in Their Management.

Note: When using the product outside Japan, it must be handled in accordance with applied laws and Regulations in that country or territory.

16. OTHER INFORMATION

TSCA Inventory Included

Reference (1) Registry of Toxic Effects of Chemical Substances (RTECS)

For further information, please contact Sales Department, Ceramics Division, Inorganic Materials Sector, SHOWA DENKO K.K.

- Telephone number: +81-263-52-1253
- Facsimile number: +81-263-52-1271

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This is a translation of original Material Safety Data Sheet prepared in Japanese.