

ruthenium(IV) oxide anhydrous low surface area (800/3A)

Section 1. Identification

Code: C8040

GHS product identifier: ruthenium(IV) oxide anhydrous low surface area (800/3A)

Chemical name: ruthenium (IV) oxide

Other means of identification: Ruthenium oxide; Ruthenium oxide (RuO₂); ruthenium dioxide

Product type: Powder.

Relevant identified uses of the substance or mixture and uses advised against: Not applicable.

Supplier's details: Johnson Matthey, 2001 Nolte Drive, West Deptford, NJ 08066 USA

Emergency telephone number (with hours of operation): For Hazardous Materials [or Dangerous Goods] Incident, Spill, Leak, Fire, Exposure, or Accident Call CHEMTREC Day or Night (collect calls accepted).
Within USA and Canada: 1-800-424-9300. Outside USA and Canada: +1 703-527-3887

Section 2. Hazards identification

OSHA/HCS status This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Classification of the substance or mixture OXIDIZING SOLIDS - Category 2

GHS label elements

Hazard pictograms



Signal word **Danger**

Hazard statements May intensify fire; oxidizer.

Precautionary statements

Prevention Wear protective clothing and eye or face protection. Keep away from incompatible materials and combustible materials.

Response Not applicable.

Storage Not applicable.

Disposal Dispose of contents and container in accordance with all local, regional, national and international regulations.

Hazards not otherwise classified Handling and/or processing of this material may generate a dust which can cause mechanical irritation of the eyes, skin, nose and throat.

Section 3. Composition/information on ingredients

Substance/mixture Substance

Chemical name ruthenium (IV) oxide

Other means of identification Ruthenium oxide; Ruthenium oxide (RuO₂); ruthenium dioxide

CAS number/other identifiers

CAS number 12036-10-1

Product code C8040

Ingredient name	%	CAS number
ruthenium (IV) oxide	100	12036-10-1

Any concentration shown as a range is to protect confidentiality or is due to batch variation.

Section 3. Composition/information on ingredients

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

- Eye contact** Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 10 minutes. Get medical attention.
- Inhalation** Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Get medical attention if adverse health effects persist or are severe. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.
- Skin contact** Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if symptoms occur. Wash clothing before reuse. Clean shoes thoroughly before reuse.
- Ingestion** Wash out mouth with water. Remove dentures if any. Remove victim to fresh air and keep at rest in a position comfortable for breathing. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Stop if the exposed person feels sick as vomiting may be dangerous. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Get medical attention if adverse health effects persist or are severe. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

Most important symptoms/effects, acute and delayed

Potential acute health effects

- Eye contact** Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the eyes.
- Inhalation** Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.
- Skin contact** No known significant effects or critical hazards.
- Ingestion** No known significant effects or critical hazards.

Over-exposure signs/symptoms

- Eye contact** Adverse symptoms may include the following:
irritation
redness
- Inhalation** Adverse symptoms may include the following:
respiratory tract irritation
coughing
- Skin contact** No specific data.
- Ingestion** No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

- Notes to physician** Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.
- Specific treatments** No specific treatment.
- Protection of first-aiders** No action shall be taken involving any personal risk or without suitable training. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media None known.

Specific hazards arising from the chemical Oxidizing material. May intensify fire.

Hazardous thermal decomposition products Decomposition products may include the following materials:
metal oxide/oxides

Special protective actions for fire-fighters Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

Special protective equipment for fire-fighters Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Remark Not available.

Remark Not available.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing dust. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders If specialized clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and materials for containment and cleaning up

Small spill Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Vacuum or sweep up material and place in a designated, labeled waste container. Dispose of via a licensed waste disposal contractor.

Large spill Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Approach release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Vacuum or sweep up material and place in a designated, labeled waste container. Avoid creating dusty conditions and prevent wind dispersal. Dispose of via a licensed waste disposal contractor. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures Put on appropriate personal protective equipment (see Section 8). Do not ingest. Avoid contact with eyes, skin and clothing. Avoid breathing dust. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Keep away from clothing, incompatible materials and combustible materials. Keep away from heat. Empty containers retain product residue and can be hazardous. Do not reuse container.

Advice on general occupational hygiene Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities Store in accordance with local regulations. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10) and food and drink. Separate from reducing agents and combustible materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

ruthenium (IV) oxide None.

Appropriate engineering controls Use only with adequate ventilation. If user operations generate dust, fumes, gas, vapor or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.

Environmental exposure controls Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: safety glasses with side-shields. If operating conditions cause high dust concentrations to be produced, use dust goggles.

Skin protection

Hand protection Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. In the case of mixtures, consisting of several substances, the protection time of the gloves cannot be accurately estimated.

Body protection Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use.

Section 9. Physical and chemical properties

Physical state	Solid. [Powder.]	Melting point	Not available.
Color	Blue. Black.	Boiling point	Not available.
Odor	Not available.	Flash point	Not available.
Odor threshold	Not available.	Burning time	Not available.
Vapor pressure	Not available.	Burning rate	Not available.
Vapor density	Not available.	Flammability (solid, gas)	Not available.
Evaporation rate	Not available.	Lower and upper explosive (flammable) limits	Not available.
Relative density	Not available.	Auto-ignition temperature	Not available.
pH	Not available.	Decomposition temperature	1200°C (2192°F)
Partition coefficient: n-octanol/water	Not available.	SADT	Not available.
Solubility in water	Not available.	Viscosity	Not available.
Solubility	Insoluble in the following materials: cold water.		

Section 10. Stability and reactivity

- Reactivity** No specific test data related to reactivity available for this product or its ingredients.
- Chemical stability** The product is stable.
- Possibility of hazardous reactions** Hazardous reactions or instability may occur under certain conditions of storage or use. Conditions may include the following:
contact with combustible materials
Reactions may include the following:
risk of causing or intensifying fire
- Conditions to avoid** No specific data.
- Incompatible materials** Reactive or incompatible with the following materials:
combustible materials
reducing materials
- Hazardous decomposition products** Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
ruthenium (IV) oxide	LD50 Oral	Rat	4580 mg/kg	-

Conclusion/Summary Not available.

Irritation/Corrosion

Not available.

Skin Not available.

Eyes Not available.

Respiratory Not available.

Sensitization

Not available.

Skin Not available.

Respiratory Not available.

Mutagenicity

Not available.

Conclusion/Summary Not available.

Carcinogenicity

Not available.

Conclusion/Summary Not available.

Reproductive toxicity

Not available.

Conclusion/Summary Not available.

Teratogenicity

Not available.

Conclusion/Summary Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Section 11. Toxicological information

Information on the likely routes of exposure Routes of entry anticipated: Dermal, Inhalation.

Potential acute health effects

Eye contact	Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the eyes.
Inhalation	Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.
Skin contact	No known significant effects or critical hazards.
Ingestion	No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact	Adverse symptoms may include the following: irritation redness
Inhalation	Adverse symptoms may include the following: respiratory tract irritation coughing
Skin contact	No specific data.
Ingestion	No specific data.

Delayed and immediate effects and also chronic effects from short and long term exposure

Short term exposure

Potential immediate effects Not available.

Potential delayed effects Not available.

Long term exposure

Potential immediate effects Not available.

Potential delayed effects Not available.

Potential chronic health effects

Not available.

Conclusion/Summary	Not available.
General	Repeated or prolonged inhalation of dust may lead to chronic respiratory irritation.
Carcinogenicity	No known significant effects or critical hazards.
Mutagenicity	No known significant effects or critical hazards.
Teratogenicity	No known significant effects or critical hazards.
Developmental effects	No known significant effects or critical hazards.
Fertility effects	No known significant effects or critical hazards.

Numerical measures of toxicity

Acute toxicity estimates

Not available.

Interactive effects Not available.

Other information Not available.

Section 12. Ecological information

Toxicity

Not available.

Conclusion/Summary Not available.

Persistence and degradability

Not available.

Conclusion/Summary Not available.

Bioaccumulative potential

Not available.

Mobility in soil




Section 12. Ecological information

Soil/water partition coefficient (K _{oc})	Not available.
Mobility	Not available.
Other adverse effects	No known significant effects or critical hazards.

Section 13. Disposal considerations

Disposal methods	The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Empty containers or liners may retain some product residues. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.
Waste stream	Not available.
RCRA classification	Not available.

Section 14. Transport information

	DOT Classification	IMDG	IATA
UN number	UN1479	UN1479	UN1479
UN proper shipping name	Oxidizing solid, n.o.s. (Ruthenium Compound, solid)	OXIDIZING SOLID, N.O. S. (Ruthenium Compound, solid)	Oxidizing solid, n.o.s. (Ruthenium Compound, solid)
Transport hazard class(es) and Packing group	5.1 II 	5.1 II 	5.1 II 
Environmental hazards	No.	No.	No.
Additional information	<p>Limited quantity Yes.</p> <p>Packaging instruction Passenger aircraft Quantity limitation: 5 kg</p> <p>Cargo aircraft Quantity limitation: 25 kg</p> <p>Special provisions 62, IB8, IP2, IP4, T3, TP33</p>	<p>Emergency schedules (EmS) F-A, S-Q</p> <p>Special provisions 274, 900</p>	<p>Passenger and Cargo Aircraft Quantity limitation: 5 kg Packaging instructions: 558</p> <p>Cargo Aircraft Only Quantity limitation: 25 kg Packaging instructions: 562</p> <p>Limited Quantities - Passenger Aircraft Quantity limitation: 2.5 kg Packaging instructions: Y544</p> <p>Special provisions A3</p>

Special precautions for user	Avoid exposure. ERG No. 140
Transport in bulk according to Annex II of MARPOL and the IBC Code	Not available.
Proper shipping name	Not available.
Ship type	Not available.
Pollution category	Not available.

Section 15. Regulatory information

U.S. Federal regulations TSCA 8(a) CDR Exempt/Partial exemption: Not determined
United States inventory (TSCA 8b): This material is listed or exempted.

Clean Air Act Section 112(b) Hazardous Air Pollutants (HAPs) Not listed
 Clean Air Act Section 602 Class I Substances Not listed
 Clean Air Act Section 602 Class II Substances Not listed
 DEA List I Chemicals (Precursor Chemicals) Not listed
 DEA List II Chemicals (Essential Chemicals) Not listed

SARA 302/304

Composition/information on ingredients

No products were found.

SARA 304 RQ Not applicable.

SARA 311/312

Classification Fire hazard

Composition/information on ingredients

Name	%	Fire hazard	Sudden release of pressure	Reactive	Immediate (acute) health hazard	Delayed (chronic) health hazard
ruthenium (IV) oxide	100	Yes.	No.	No.	No.	No.

State regulations

Massachusetts This material is not listed.
 New York This material is not listed.
 New Jersey This material is not listed.
 Pennsylvania This material is not listed.

Not available.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol (Annexes A, B, C, E)

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Inform Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

International lists

National inventory

Australia This material is listed or exempted.
 Canada This material is listed or exempted.
 China This material is listed or exempted.
 Europe This material is listed or exempted.
 Japan **Japan inventory (ENCS):** This material is listed or exempted.
Japan inventory (ISHL): Not determined.
 Malaysia Not determined.

Section 15. Regulatory information

New Zealand	Not determined.
Philippines	This material is listed or exempted.
Republic of Korea	This material is listed or exempted.
Taiwan	This material is listed or exempted.
Turkey	Not determined.

Section 16. Other information

Procedure used to derive the classification


Classification	Justification
OXIDIZING SOLIDS - Category 2	Expert judgment

History

Date of printing	10/01/2017
Date of issue/Date of revision	10/01/2017
Date of previous issue	29/11/2016
Version	3
Prepared by	Not available.
Key to abbreviations	ATE = Acute Toxicity Estimate BCF = Bioconcentration Factor GHS = Globally Harmonized System of Classification and Labelling of Chemicals IATA = International Air Transport Association IBC = Intermediate Bulk Container IMDG = International Maritime Dangerous Goods LogPow = logarithm of the octanol/water partition coefficient MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution) UN = United Nations
References	Not available.

 Indicates information that has changed from previously issued version.

US Label (29 CFR 1910.1200(f)(1))

<p>ruthenium(IV) oxide anhydrous low surface area (800/3A)</p> <p>CAS: 12036-10-1 Code: C8040</p> <p>Danger</p> <p>May intensify fire; oxidizer.</p> <p>Wear protective clothing and eye or face protection. Keep away from incompatible materials and combustible materials. Dispose of contents and container in accordance with all local, regional, national and international regulations. Read SDS before using this product. Do not handle until all safety precautions have been read and understood.</p> <p><small>Johnson Matthey 2001 Nolte Drive, West Deptford, NJ 08066 USA non-emergencies: +1 856 384 7050; emergencies +1 800 424 9300</small></p>	
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