

## SAFETY DATA SHEET PACKET

### Product Identifier

**SRM Number:** 674b

**SRM Name:** X-Ray Powder Diffraction Intensity Set (Quantitative Powder Diffraction Standard)

### SRM Description:

A unit of SRM 674b consists of four bottles containing approximately 10 g of each oxide powder (ZnO, TiO<sub>2</sub>, Cr<sub>2</sub>O<sub>3</sub>, and CeO<sub>2</sub>), bottled in an argon atmosphere. Attached are the individual Safety Data Sheets for the materials in this Standard Reference Material (SRM).

### SRM 674b Parts:

X-Ray Powder Diffraction Intensity Set ZnO (Zinc Oxide)

X-Ray Powder Diffraction Intensity Set TiO<sub>2</sub> (Titanium Dioxide)

X-Ray Powder Diffraction Intensity Set Cr<sub>2</sub>O<sub>3</sub> (Chromium Oxide)

X-Ray Powder Diffraction Intensity Set CeO<sub>2</sub> (Cerium Oxide)

### Company Information

National Institute of Standards and Technology  
Standard Reference Materials Program  
100 Bureau Drive, Stop 2300  
Gaithersburg, Maryland 20899-2300

Telephone: 301-975-2200

FAX: 301-948-3730

E-mail: SRMMSDS@nist.gov

Website: <http://www.nist.gov/srm>

Emergency Telephone ChemTrec:

1-800-424-9300 (North America)

+1-703-527-3887 (International)

## SAFETY DATA SHEET

### 1. SUBSTANCE AND SOURCE IDENTIFICATION

**Product Identifier**

**SRM Number:** 674b  
**SRM Name:** X-Ray Powder Diffraction Intensity Set (Quantitative Powder Diffraction Standard)  
**SRM Part:** X-Ray Powder Diffraction Intensity Set ZnO (Zinc Oxide)  
**Other Means of Identification:** Not applicable.

**Recommended Use of This Material and Restrictions of Use**

This Standard Reference Material (SRM) is intended primarily for use as internal standards for quantitative X-ray diffraction analysis. This A unit of SRM 674b consists of four bottles containing approximately 10 g of each oxide powder (ZnO, TiO<sub>2</sub>, Cr<sub>2</sub>O<sub>3</sub>, and CeO<sub>2</sub>), bottled in an argon atmosphere.

**Company Information**

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Website: <http://www.nist.gov/srm>

Emergency Telephone ChemTrec:  
1-800-424-9300 (North America)  
+1-703-527-3887 (International)

### 2. HAZARDS IDENTIFICATION

**Note:** This SDS is for ZnO; see additional SDSs for the classification for TiO<sub>2</sub>, Cr<sub>2</sub>O<sub>3</sub>, and CeO<sub>2</sub>.

**Classification**

**Physical Hazard:** Not classified.  
**Health Hazard:** Not classified.

**Label Elements**

**Symbol:** No symbol/No pictogram

**Signal Word:** No signal word

**Hazard Statement(s):** Not applicable.

**Precautionary Statement(s):** Not applicable.

**Hazards Not Otherwise Classified:** Not applicable.

**Ingredients(s) with Unknown Acute Toxicity:** Not applicable.

### 3. COMPOSITION AND INFORMATION ON HAZARDOUS INGREDIENTS

**Substance:** Zinc Oxide

**Other Designations:** Zinc white; Chinese white; flowers of zinc; zinc monoxide; zinc gelatin; white zinc; permanent white; philosophers wool; zincoïd; snow white; ZnO

Components are listed in compliance with OSHA's 29 CFR 1910.1200; for the actual values see the NIST Certificate of Analysis.

Hazardous Component(s)	CAS Number	EC Number (EINECS)	Nominal Mass Concentration (%)
Zinc Oxide	1314-13-2	215-222-5	100

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## 4. FIRST AID MEASURES

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### Description of First Aid Measures:

**Inhalation:** If adverse effects occur, remove to uncontaminated area. If not breathing, give artificial respiration or oxygen by qualified personnel. Seek immediate medical attention.

**Skin Contact:** Wash skin with soap and water for at least 15 minutes. Thoroughly clean and dry contaminated clothing before reuse.

**Eye Contact:** Flush eyes with water for at least 15 minutes. If necessary, seek medical attention.

**Ingestion:** If a large amount is swallowed, get medical attention.

**Most Important Symptoms/Effects, Acute and Delayed:** May cause irritation.

**Indication of any immediate medical attention and special treatment needed, if necessary:** If any of the above symptoms are present, seek medical attention if needed.

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## 5. FIRE FIGHTING MEASURES

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**Fire and Explosion Hazards:** Negligible fire hazard. See Section 9, "Physical and Chemical Properties" for flammability properties.

### Extinguishing Media:

Suitable: Regular dry chemical, carbon dioxide, water, regular foam.

Unsuitable: None listed.

**Specific Hazards Arising from the Chemical:** None listed.

**Special Protective Equipment and Precautions for Fire-Fighters:** Avoid inhalation of material or combustion byproducts. Wear full protective clothing and NIOSH approved self-contained breathing apparatus (SCBA).

**NFPA Ratings** (0 = Minimal; 1 = Slight; 2 = Moderate; 3 = Serious; 4 = Severe)

Health = 0

Fire = 0

Reactivity = 0

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## 6. ACCIDENTAL RELEASE MEASURES

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**Personal Precautions, Protective Equipment and Emergency Procedures:** Use suitable protective equipment; see Section 8, "Exposure Controls and Personal Protection".

**Methods and Materials for Containment and Clean up:** Collect spilled material in appropriate container for disposal. Avoid generating dust. Clean up residue with a high-efficiency particulate filter vacuum.

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## 7. HANDLING AND STORAGE

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**Safe Handling Precautions:** Minimize dust generation. See Section 8, "Exposure Controls and Personal Protection".

**Storage:** It is recommended that the unused portion of the powder be stored in a tightly capped container such as the original bottle or in a manner to protect against humidity. Store and handling in accordance with all current regulations and standards. Keep separated from incompatible substances (See Section 10, "Stability and Reactivity").

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## 8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

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### Exposure Limits:

ACGIH (TLV): 2 mg/m<sup>3</sup> (TWA, respirable particulates)  
10 mg/m<sup>3</sup> (STEL, respirable particulates)

NIOSH (REL): 5 mg/m<sup>3</sup> (TWA, dust and fume)  
10 mg/m<sup>3</sup> (STEL, fume)  
15 mg/m<sup>3</sup> (Ceiling, dust)  
500 mg/m<sup>3</sup> (IDLH)

OSHA (PEL): 5 mg/m<sup>3</sup> (TWA, fume)  
15 mg/m<sup>3</sup> (TWA, total dust)  
5 mg/m<sup>3</sup> (TWA, respirable fraction)

**Engineering Controls:** Provide local exhaust or process enclosure ventilation system. Ensure compliance with applicable exposure limits.

**Personal Protection:** In accordance with OSHA 29 CFR 1910.132, subpart I, wear appropriate Personal Protective Equipment (PPE) to minimize exposure to this material.

**Respiratory Protection:** If workplace conditions warrant a respirator, a respiratory protection program that meets OSHA 29CFR 1910.134 must be followed. Refer to NIOSH 42 CFR 84 for applicable certified respirators.

**Eye/Face Protection:** Wear splash resistant safety goggles with a face shield. An eye wash station should be readily available near areas of use.

**Skin and 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. Chemical-resistant gloves should be worn at all times when handling chemicals.

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## 9. PHYSICAL AND CHEMICAL PROPERTIES

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### Descriptive Properties:

<b>Appearance</b> (physical state, color, etc.):	white or gray, powder
<b>Molecular Formula:</b>	ZnO
<b>Molar Mass (g/mol):</b>	81.37
<b>Odor:</b>	odorless
<b>Odor threshold:</b>	not available
<b>pH (solution):</b>	6.95 to 7.37
<b>Evaporation rate:</b>	not applicable
<b>Melting point/freezing point (°C):</b>	1975 (3587 °F)
<b>Relative Density (g/mL):</b>	5.6
<b>Vapor Pressure (mmHg):</b>	0.0 at 21 °C
<b>Vapor Density (air = 1):</b>	>1
<b>Viscosity (cP):</b>	not applicable
<b>Solubility(ies):</b>	water soluble (1.6 ppm at 29 °C); soluble in dilute acetic acid, mineral acids, ammonia, ammonium chloride solutions, ammonium salt solutions, fixed alkali hydroxide solutions, strong alkali
<b>Partition coefficient (n-octanol/water):</b>	not available
<b>Particle Size:</b>	not available

### Thermal Stability Properties:

<b>Autoignition Temperature (°C):</b>	not applicable
<b>Thermal Decomposition (°C):</b>	not available
<b>Initial boiling point and boiling range (°C):</b>	not applicable
<b>Explosive Limits, LEL (Volume %):</b>	not applicable
<b>Explosive Limits, UEL (Volume %):</b>	not applicable
<b>Flash Point (°C):</b>	not applicable
<b>Flammability (solid, gas):</b>	not available

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## 10. STABILITY AND REACTIVITY

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**Reactivity:** Stable at normal temperatures and pressure.

**Stability:**     X      Stable     \_\_\_\_\_  Unstable

**Possible Hazardous Reactions:** None listed.

**Conditions to Avoid:** Avoid generating dust.

**Incompatible Materials:** Halo carbons, combustible materials, metals, acids, oxidizing materials.

**Fire/Explosion Information:** See Section 5, "Fire Fighting Measures".

**Hazardous Decomposition:** Thermal decomposition will produce zinc, oxides of zinc.

**Hazardous Polymerization:** \_\_\_\_\_ Will Occur        X   Will Not Occur

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## 11. TOXICOLOGICAL INFORMATION

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**Route of Exposure:**        X   Inhalation      \_\_\_\_\_ Skin        X   Ingestion

**Symptoms Related to the Physical, Chemical and Toxicological Characteristics:** Exposure may cause irritation.

**Potential Health Effects (Acute, Chronic and Delayed):**

**Inhalation:** Acute: irritation; inhaled fumes may cause metal fume fever, difficulty breathing; chronic: nausea and liver damage.

**Skin Contact:** Acute: low potential for skin irritation, although it can alter skin pigmentation; chronic: skin disorders.

**Eye Contact:** Acute: mechanical irritation, redness, and pain; chronic: no information available.

**Ingestion:** Acute: nausea, diarrhea, constipation; chronic: no information available.

**Numerical Measures of Toxicity:**

**Acute Toxicity:** Not classified.

Rat, Oral LD50: >5000 mg/kg

Mouse, Inhalation LC50: 2500 mg/m<sup>3</sup>

**Skin Corrosion/Irritation:** Not classified.

Rabbit, Skin (mild): 500 mg (24 h)

**Serious Eye damage/Eye irritation:** Not classified.

Rabbit, Eyes (mild): 500 mg (24 h)

**Respiratory Sensitization:** Not classified; no data available.

**Skin Sensitization:** Not classified; no data available.

**Germ Cell Mutagenicity:** Not classified; no data available.

**Carcinogenicity:** Not classified.

**Listed as a Carcinogen/Potential Carcinogen**      \_\_\_\_\_ Yes        X   No

Zinc oxide is not listed by IARC, NTP or OSHA as a carcinogen.

**Reproductive Toxicity:** Not classified.

Rat, Oral TDLo: 6846 mg/kg (pregnant 1 d to 22 d)

**Specific Target Organ Toxicity, Single Exposure:** Not classified; no data available.

**Specific Target Organ Toxicity, Repeated Exposure:** Not classified; no data available.

**Aspiration Hazard:** Not classified; no data available.

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## 12. ECOLOGICAL INFORMATION

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**Ecotoxicity Data:** No data available.

**Persistence and Degradability:** No data available.

**Bioaccumulative Potential:** No data available.

**Mobility in Soil:** No data available.

**Other Adverse effects:** No data available.

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## 13. DISPOSAL CONSIDERATIONS

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**Waste Disposal:** Dispose of waste in accordance with all applicable federal, state, and local regulations.

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## 14. TRANSPORTATION INFORMATION

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**U.S. DOT and IATA:** Not regulated by DOT or IATA.

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## 15. REGULATORY INFORMATION

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### U.S. Regulations:

CERCLA Sections 102a/103 (40 CFR 302.4): Not regulated.  
SARA Title III Section 302 (40 CFR 355.30): Not regulated.  
SARA Title III Section 304 (40 CFR 355.40): Not regulated.  
SARA Title III Section 313 (40 CFR 372.65): 1.0 % de minimis concentration (related to Zinc compounds).  
OSHA Process Safety (29 CFR 1910.119): Not regulated.  
SARA Title III Sections 311/312 Hazardous Categories (40 CFR 370.21):

ACUTE HEALTH: No.  
CHRONIC HEALTH: No.  
FIRE: No.  
REACTIVE: No.  
PRESSURE: No.

### State Regulations:

California Proposition 65: Not listed.

U.S. TSCA Inventory: Listed.

TSCA 12(b), Export Notification: Not listed.

### Canadian Regulations:

WHMIS Information: Not provided for this material.

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## 16. OTHER INFORMATION

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Issue Date: 10 October 2017

Sources: ChemAdvisor, Inc., MSDS *Zinc Oxide*, 09 December 2015.

### Key of Acronyms:

ACGIH	American Conference of Governmental Industrial Hygienists	NIOSH	National Institute for Occupational Safety and Health
ALI	Annual Limit on Intake	NIST	National Institute of Standards and Technology
CAS	Chemical Abstracts Service	NRC	Nuclear Regulatory Commission
CEN	European Committee for Standardization	NTP	National Toxicology Program
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act	OSHA	Occupational Safety and Health Administration
CFR	Code of Federal Regulations	PEL	Permissible Exposure Limit
CPSU	Coal Mine Dust Personal Sample Unit	RCRA	Resource Conservation and Recovery Act
DOT	Department of Transportation	REL	Recommended Exposure Limit
EC50	Effective Concentration, 50 %	RM	Reference Material
EINECS	European Inventory of Existing Commercial Chemical Substances	RQ	Reportable Quantity
EPCRA	Emergency Planning and Community Right-to-Know Act	RTECS	Registry of Toxic Effects of Chemical Substances
IARC	International Agency for Research on Cancer	SARA	Superfund Amendments and Reauthorization Act
IATA	International Air Transport Association	SCBA	Self-Contained Breathing Apparatus
IDLH	Immediately Dangerous to Life and Health	SRM	Standard Reference Material
ISO	International Organization for Standardization	STEL	Short Term Exposure Limit
LC50	Lethal Concentration, 50 %	TDLo	Toxic Dose Low
LD50	Lethal Dose, 50 %	TLV	Threshold Limit Value
LEL	Lower Explosive Limit	TPQ	Threshold Planning Quantity
MSDS	Material Safety Data Sheet	TSCA	Toxic Substances Control Act
NFPA	National Fire Protection Association	TWA	Time Weighted Average
MSHA	Mine Safety and Health Administration	UEL	Upper Explosive Limit
		WHMIS	Workplace Hazardous Materials Information System

**Disclaimer:** Physical and chemical data contained in this SDS are provided only for use in assessing the hazardous nature of the material. The SDS was prepared carefully, using current references; however, NIST does not certify the data in the SDS. The certified values for this material are given in the NIST Certificate of Analysis.

Users of this SRM should ensure that the SDS in their possession is current. This can be accomplished by contacting the SRM Program: telephone (301) 975-2200; fax (301) 948-3730; e-mail [srmmsds@nist.gov](mailto:srmmsds@nist.gov); or via the Internet at <http://www.nist.gov/srm>.

## SAFETY DATA SHEET

### 1. SUBSTANCE AND SOURCE IDENTIFICATION

**Product Identifier**

**SRM Number:** 674b  
**SRM Name:** X-Ray Powder Diffraction Intensity Set (Quantitative Powder Diffraction Standard)  
**SRM Part:** X-Ray Powder Diffraction Intensity Set TiO<sub>2</sub> (Titanium Dioxide)  
**Other Means of Identification:** Not applicable.

**Recommended Use of This Material and Restrictions of Use**

This Standard Reference Material (SRM) is intended primarily for use as internal standards for quantitative X-ray diffraction analysis. A unit of SRM 674b consists of four bottles containing approximately 10 g of each oxide powder (ZnO, TiO<sub>2</sub>, Cr<sub>2</sub>O<sub>3</sub>, and CeO<sub>2</sub>), bottled in an argon atmosphere.

**Company Information**

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Website: <http://www.nist.gov/srm>

Emergency Telephone ChemTrec:  
1-800-424-9300 (North America)  
+1-703-527-3887 (International)

### 2. HAZARDS IDENTIFICATION

**Note:** This SDS is for TiO<sub>2</sub>; see additional SDSs for the classification for ZnO, Cr<sub>2</sub>O<sub>3</sub>, and CeO<sub>2</sub>.

**Classification**

**Physical Hazard:** Not classified.  
**Health Hazard:** Carcinogenicity Category 2

**Label Elements****Symbol****Signal Word**

WARNING

**Hazard Statement(s):**

H351 Suspected of causing cancer (inhalation).

**Precautionary Statement(s):**

P201 Obtain special instructions before use.  
P202 Do not handle until all safety precautions have been read and understood.  
P281 Use personal protective equipment as required.  
P308+P313 If exposed or concerned: Get medical attention.  
P405 Store locked up.  
P501 Dispose of contents and container in accordance with local regulations.

**Hazards Not Otherwise Classified:** Not applicable.

**Ingredients(s) with Unknown Acute Toxicity:** Not applicable.

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### 3. COMPOSITION AND INFORMATION ON HAZARDOUS INGREDIENTS

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**Substance:** Titanium Dioxide

**Other Designations:** Titanium oxide; titanium dioxide: TiO<sub>2</sub>; titanium peroxide; titanic oxide; brookite; rutile

Components are listed in compliance with OSHA's 29 CFR 1910.1200; for the actual values see the NIST Certificate of Analysis.

Hazardous Component(s)	CAS Number	EC Number (EINECS)	Nominal Mass Concentration (%)
Titanium Dioxide	13463-67-7	236-675-5	100

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### 4. FIRST AID MEASURES

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**Description of First Aid Measures:**

**Inhalation:** If adverse effects occur, remove to uncontaminated area. If not breathing, give artificial respiration or oxygen by qualified personnel. Seek immediate medical attention.

**Skin Contact:** Wash skin with soap and water for at least 15 minutes. Thoroughly clean and dry contaminated clothing before reuse.

**Eye Contact:** Flush eyes with water for at least 15 minutes. If necessary, seek medical attention.

**Ingestion:** If a large amount is swallowed, get medical attention.

**Most Important Symptoms/Effects, Acute and Delayed:** Irritation, cancer inhalation hazard.

**Indication of any immediate medical attention and special treatment needed, if necessary:** If any of the above symptoms are present, seek medical attention if needed.

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### 5. FIRE FIGHTING MEASURES

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**Fire and Explosion Hazards:** Negligible fire hazard. See Section 9, "Physical and Chemical Properties" for flammability properties.

**Extinguishing Media:**

Suitable: Use extinguishing agents appropriate for surrounding fire.

Unsuitable: None listed.

**Specific Hazards Arising from the Chemical:** None listed.

**Special Protective Equipment and Precautions for Fire-Fighters:** Avoid inhalation of material or combustion byproducts. Wear full protective clothing and NIOSH approved self-contained breathing apparatus (SCBA).

**NFPA Ratings** (0 = Minimal; 1 = Slight; 2 = Moderate; 3 = Serious; 4 = Severe)

Health = 1

Fire = 0

Reactivity = 0

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### 6. ACCIDENTAL RELEASE MEASURES

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**Personal Precautions, Protective Equipment and Emergency Procedures:** Use suitable protective equipment; see Section 8, "Exposure Controls and Personal Protection".

**Methods and Materials for Containment and Clean up:** Collect spilled material in appropriate container for disposal. Avoid generating dust.

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### 7. HANDLING AND STORAGE

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**Safe Handling Precautions:** Minimize dust generation. See Section 8, "Exposure Controls and Personal Protection".

**Storage:** It is recommended that the unused portion of the powder be stored in a tightly capped container such as the original bottle or in a manner to protect against humidity. Store and handling in accordance with all current regulations and standards. Keep separated from incompatible substances (See Section 10, "Stability and Reactivity").



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## 8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

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### Exposure Limits:

ACGIH (TLV): 10 mg/m<sup>3</sup> (TWA)  
5000 mg/m<sup>3</sup> (IDLH)

NIOSH (REL): No occupational exposure limits available.

OSHA (PEL): 15 mg/m<sup>3</sup> (TWA, total dust)

**Engineering Controls:** Provide local exhaust or process enclosure ventilation system. Ensure compliance with applicable exposure limits.

**Personal Protection:** In accordance with OSHA 29 CFR 1910.132, subpart I, wear appropriate Personal Protective Equipment (PPE) to minimize exposure to this material.

**Respiratory Protection:** If workplace conditions warrant a respirator, a respiratory protection program that meets OSHA 29CFR 1910.134 must be followed. Refer to NIOSH 42 CFR 84 for applicable certified respirators.

**Eye/Face Protection:** Wear splash resistant safety goggles with a face shield. An eye wash station should be readily available near areas of use.

**Skin and 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. Chemical-resistant gloves should be worn at all times when handling chemicals.

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## 9. PHYSICAL AND CHEMICAL PROPERTIES

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### Descriptive Properties:

<b>Appearance</b> (physical state, color, etc.):	colorless, white or black, powder
<b>Molecular Formula:</b>	TiO <sub>2</sub>
<b>Molar Mass (g/mol):</b>	79.88
<b>Odor:</b>	odorless
<b>Odor threshold:</b>	not available
<b>pH (solution):</b>	neutral (10 % suspension)
<b>Evaporation rate:</b>	not applicable
<b>Melting point/freezing point (°C):</b>	1825 to 1850 (3317 °F to 3362 °F)
<b>Relative Density</b> as Specific Gravity (water = 1):	3.84 to 4.26
<b>Vapor Pressure (mmHg):</b>	not applicable
<b>Vapor Density (air = 1):</b>	not applicable
<b>Viscosity (cP):</b>	not applicable
<b>Solubility(ies):</b>	soluble in hot concentrated sulfuric acid, hydrofluoric acid, alkali; insoluble in water, hydrochloric acid, nitric acid, dilute sulfuric acid.
<b>Partition coefficient (n-octanol/water):</b>	not available
<b>Particle Size:</b>	not available

### Thermal Stability Properties:

<b>Autoignition Temperature (°C):</b>	not applicable
<b>Thermal Decomposition (°C):</b>	not available
<b>Initial boiling point and boiling range (°C):</b>	2500 to 3000 (4532 °F to 5432 °F)
<b>Explosive Limits, LEL (Volume %):</b>	not applicable
<b>Explosive Limits, UEL (Volume %):</b>	not applicable
<b>Flash Point (°C):</b>	not applicable
<b>Flammability (solid, gas):</b>	not available

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## 10. STABILITY AND REACTIVITY

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**Reactivity:** Stable at normal temperatures and pressure.

**Stability:**   X   Stable        Unstable

**Possible Hazardous Reactions:** None listed.

**Conditions to Avoid:** Avoid generating dust.

**Incompatible Materials:** Metals.

**Fire/Explosion Information:** See Section 5, "Fire Fighting Measures".

**Hazardous Decomposition:** Thermal decomposition will produce oxides of titanium.

**Hazardous Polymerization:**        Will Occur   X   Will Not Occur

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## 11. TOXICOLOGICAL INFORMATION

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**Route of Exposure:**   X   Inhalation   X   Skin        Ingestion

**Symptoms Related to the Physical, Chemical and Toxicological Characteristics:** Exposure may cause irritation; inhalation may cause cancer.

**Potential Health Effects (Acute, Chronic and Delayed):**

**Inhalation:** Acute: irritation, cough; chronic: same as acute, difficulty breathing, may cause cancer.

**Skin Contact:** Acute: no information available; chronic: irritation.

**Eye Contact:** No information available.

**Ingestion:** No information available.

**Numerical Measures of Toxicity:**

**Acute Toxicity:** Not classified.

Rat, Oral LD50: >10 000 mg/kg

**Skin Corrosion/Irritation:** Not classified.

Human, Skin intermittent (mild): 300 ug (3 d)

**Serious Eye damage/Eye irritation:** Not classified; no data available.

**Respiratory Sensitization:** Not classified; no data available.

**Skin Sensitization:** Not classified; no data available.

**Germ Cell Mutagenicity:** Not classified; no data available.

**Carcinogenicity:** Category 2.

**Listed as a Carcinogen/Potential Carcinogen**   X   Yes        No

Titanium dioxide is listed by IARC as Group 2B (*possibly carcinogenic to humans*). Titanium dioxide is not listed by NTP or OSHA as a carcinogen.

**Reproductive Toxicity:** Not classified; no data available.

**Specific Target Organ Toxicity, Single Exposure:** Not classified; no data available.

**Specific Target Organ Toxicity, Repeated Exposure:** Not classified; no data available.

**Aspiration Hazard:** Not classified; no data available.

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## 12. ECOLOGICAL INFORMATION

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**Ecotoxicity Data:** No data available.

**Persistence and Degradability:** No data available.

**Bioaccumulative Potential:** No data available.

**Mobility in Soil:** No data available.

**Other Adverse effects:** No data available.

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### 13. DISPOSAL CONSIDERATIONS

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**Waste Disposal:** Dispose of waste in accordance with all applicable federal, state, and local regulations.

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### 14. TRANSPORTATION INFORMATION

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**U.S. DOT and IATA:** Not regulated by DOT or IATA.

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### 15. REGULATORY INFORMATION

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**U.S. Regulations:**

CERCLA Sections 102a/103 (40 CFR 302.4): Not regulated.

SARA Title III Section 302 (40 CFR 355.30): Not regulated.

SARA Title III Section 304 (40 CFR 355.40): Not regulated.

SARA Title III Section 313 (40 CFR 372.65): Not regulated.

OSHA Process Safety (29 CFR 1910.119): Not regulated.

SARA Title III Sections 311/312 Hazardous Categories (40 CFR 370.21):

ACUTE HEALTH: No.

CHRONIC HEALTH: Yes.

FIRE: No.

REACTIVE: No.

PRESSURE: No.

**State Regulations:**

California Proposition 65: WARNING! This product contains a chemical (titanium dioxide) known to the state of California to cause cancer.

**U.S. TSCA Inventory:** Listed.

**TSCA 12(b), Export Notification:** Not listed.

**Canadian Regulations:**

WHMIS Information: Not provided for this material.

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### 16. OTHER INFORMATION

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**Issue Date:** 10 October 2017

**Sources:** ChemAdvisor, Inc., MSDS *Titanium Dioxide*, 09 December 2015.

### Key of Acronyms:

ACGIH	American Conference of Governmental Industrial Hygienists	NIOSH	National Institute for Occupational Safety and Health
ALI	Annual Limit on Intake	NIST	National Institute of Standards and Technology
CAS	Chemical Abstracts Service	NRC	Nuclear Regulatory Commission
CEN	European Committee for Standardization	NTP	National Toxicology Program
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act	OSHA	Occupational Safety and Health Administration
CFR	Code of Federal Regulations	PEL	Permissible Exposure Limit
CPSU	Coal Mine Dust Personal Sample Unit	RCRA	Resource Conservation and Recovery Act
DOT	Department of Transportation	REL	Recommended Exposure Limit
EC50	Effective Concentration, 50 %	RM	Reference Material
EINECS	European Inventory of Existing Commercial Chemical Substances	RQ	Reportable Quantity
EPCRA	Emergency Planning and Community Right-to-Know Act	RTECS	Registry of Toxic Effects of Chemical Substances
IARC	International Agency for Research on Cancer	SARA	Superfund Amendments and Reauthorization Act
IATA	International Air Transport Association	SCBA	Self-Contained Breathing Apparatus
IDLH	Immediately Dangerous to Life and Health	SRM	Standard Reference Material
ISO	International Organization for Standardization	STEL	Short Term Exposure Limit
LC50	Lethal Concentration, 50 %	TDLo	Toxic Dose Low
LD50	Lethal Dose, 50 %	TLV	Threshold Limit Value
LEL	Lower Explosive Limit	TPQ	Threshold Planning Quantity
MSDS	Material Safety Data Sheet	TSCA	Toxic Substances Control Act
NFPA	National Fire Protection Association	TWA	Time Weighted Average
MSHA	Mine Safety and Health Administration	UEL	Upper Explosive Limit
		WHMIS	Workplace Hazardous Materials Information System

**Disclaimer:** Physical and chemical data contained in this SDS are provided only for use in assessing the hazardous nature of the material. The SDS was prepared carefully, using current references; however, NIST does not certify the data in the SDS. The certified values for this material are given in the NIST Certificate of Analysis.

Users of this SRM should ensure that the SDS in their possession is current. This can be accomplished by contacting the SRM Program: telephone (301) 975-2200; fax (301) 948-3730; e-mail [srmmsds@nist.gov](mailto:srmmsds@nist.gov); or via the Internet at <http://www.nist.gov/srm>.

## SAFETY DATA SHEET

### 1. SUBSTANCE AND SOURCE IDENTIFICATION

**Product Identifier**

**SRM Number:** 674b  
**SRM Name:** X-Ray Powder Diffraction Intensity Set (Quantitative Powder Diffraction Standard)  
**SRM Part:** X-Ray Powder Diffraction Intensity Set Cr<sub>2</sub>O<sub>3</sub> (Chromium Oxide)  
**Other Means of Identification:** Not applicable.

**Recommended Use of This Material and Restrictions of Use**

This Standard Reference Material (SRM) is intended primarily for use as internal standards for quantitative X-ray diffraction analysis. A unit of SRM 674b consists of four bottles containing approximately 10 g of each oxide powder (ZnO, TiO<sub>2</sub>, Cr<sub>2</sub>O<sub>3</sub>, and CeO<sub>2</sub>), bottled in an argon atmosphere.

**Company Information**

National Institute of Standards and Technology  
Standard Reference Materials Program  
100 Bureau Drive, Stop 2300  
Gaithersburg, Maryland 20899-2300

Telephone: 301-975-2200  
FAX: 301-948-3730  
E-mail: SRMMSDS@nist.gov  
Website: <http://www.nist.gov/srm>

Emergency Telephone ChemTrec:  
1-800-424-9300 (North America)  
+1-703-527-3887 (International)

### 2. HAZARDS IDENTIFICATION

**Note:** This SDS is for Cr<sub>2</sub>O<sub>3</sub>; see additional SDSs for the classification for ZnO, TiO<sub>2</sub>, and CeO<sub>2</sub>.

**Classification**

**Physical Hazard:** Not classified.  
**Health Hazard:** Not classified.

**Label Elements**

**Symbol:** No symbol/No pictogram

**Signal Word:** No signal word

**Hazard Statement(s):** Not applicable.

**Precautionary Statement(s):** Not applicable.

**Hazards Not Otherwise Classified:** Not applicable.

**Ingredients(s) with Unknown Acute Toxicity:** Not applicable.

### 3. COMPOSITION AND INFORMATION ON HAZARDOUS INGREDIENTS

**Substance:** Chromium oxide

**Other Designations:** Chromium (III) oxide; chromic oxide; dichromium trioxide; chrome oxide; anadomis green; casalis green oxide pigment; chromia; chromium sesquioxide; green rouge; Cr<sub>2</sub>O<sub>3</sub>

Components are listed in compliance with OSHA's 29 CFR 1910.1200; for the actual values see the NIST Certificate of Analysis.

Hazardous Component(s)	CAS Number	EC Number (EINECS)	Nominal Mass Concentration (%)
Chromium Oxide	1308-38-9	215-160-9	100

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## 4. FIRST AID MEASURES

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### Description of First Aid Measures:

**Inhalation:** If adverse effects occur, remove to uncontaminated area. If not breathing, give artificial respiration or oxygen by qualified personnel. Seek immediate medical attention.

**Skin Contact:** Wash skin with soap and water for at least 15 minutes. Thoroughly clean and dry contaminated clothing before reuse.

**Eye Contact:** Flush eyes with water for at least 15 minutes. If necessary, seek medical attention.

**Ingestion:** If a large amount is swallowed, get medical attention.

**Most Important Symptoms/Effects, Acute and Delayed:** May cause irritation and allergic reactions.

**Indication of any immediate medical attention and special treatment needed, if necessary:** If any of the above symptoms are present, seek medical attention if needed.

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## 5. FIRE FIGHTING MEASURES

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**Fire and Explosion Hazards:** Negligible fire hazard. Dust/air mixtures may ignite or explode. See Section 9, "Physical and Chemical Properties" for flammability properties.

### Extinguishing Media:

Suitable: Use extinguishing agents appropriate for surrounding fire.

Unsuitable: None listed.

**Specific Hazards Arising from the Chemical:** None listed.

**Special Protective Equipment and Precautions for Fire-Fighters:** Avoid inhalation of material or combustion byproducts. Wear full protective clothing and NIOSH approved self-contained breathing apparatus (SCBA).

**NFPA Ratings** (0 = Minimal; 1 = Slight; 2 = Moderate; 3 = Serious; 4 = Severe)

Health = 1

Fire = 0

Reactivity = 0

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## 6. ACCIDENTAL RELEASE MEASURES

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**Personal Precautions, Protective Equipment and Emergency Procedures:** Use suitable protective equipment; see Section 8, "Exposure Controls and Personal Protection".

**Methods and Materials for Containment and Clean up:** Collect spilled material in appropriate container for disposal. Avoid generating dust.

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## 7. HANDLING AND STORAGE

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**Safe Handling Precautions:** Minimize dust generation. See Section 8, "Exposure Controls and Personal Protection".

**Storage:** It is recommended that the unused portion of the powder be stored in a tightly capped container such as the original bottle or in a manner to protect against humidity. Store and handling in accordance with all current regulations and standards. Keep separated from incompatible substances (See Section 10, "Stability and Reactivity").

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## 8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

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**Exposure Limits:** [as Cr, related to Chromium(III) compounds]

ACGIH (TLV): No occupational exposure limits established.

NIOSH (REL): 0.5 mg/m<sup>3</sup> (TWA)  
25 mg/m<sup>3</sup> (IDLH)

OSHA (PEL): 0.5 mg/m<sup>3</sup> (TWA)

**Engineering Controls:** Provide local exhaust or process enclosure ventilation system. Ensure compliance with applicable exposure limits.

**Personal Protection:** In accordance with OSHA 29 CFR 1910.132, subpart I, wear appropriate Personal Protective Equipment (PPE) to minimize exposure to this material.

**Respiratory Protection:** If workplace conditions warrant a respirator, a respiratory protection program that meets OSHA 29CFR 1910.134 must be followed. Refer to NIOSH 42 CFR 84 for applicable certified respirators.

**Eye/Face Protection:** Wear splash resistant safety goggles with a face shield. An eye wash station should be readily available near areas of use.

**Skin and 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. Chemical-resistant gloves should be worn at all times when handling chemicals.

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## 9. PHYSICAL AND CHEMICAL PROPERTIES

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### Descriptive Properties:

Appearance (physical state, color, etc.):	green powder
Molecular Formula:	Cr <sub>2</sub> O <sub>3</sub>
Molar Mass (g/mol):	151.99
Odor:	odorless
Odor threshold:	not available
pH (solution):	7.5 at 5 %
Evaporation rate:	not applicable
Melting point/freezing point (°C):	2435 (4415 °F)
Relative Density as Specific Gravity (water = 1):	5.21
Vapor Pressure (mmHg):	not available
Vapor Density (air = 1):	not available
Viscosity (cP):	not applicable
Solubility(ies):	insoluble in water, acids, alkali, alcohol, acetone
Partition coefficient (n-octanol/water):	not available
Particle Size:	not available

### Thermal Stability Properties:

Autoignition Temperature (°C):	not applicable
Thermal Decomposition (°C):	not available
Initial boiling point and boiling range (°C):	4000 (7232 °F)
Explosive Limits, LEL (Volume %):	not applicable
Explosive Limits, UEL (Volume %):	not applicable
Flash Point (°C):	not applicable
Flammability (solid, gas):	not available

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## 10. STABILITY AND REACTIVITY

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**Reactivity:** Stable at normal temperatures and pressure.

**Stability:**       X       Stable                Unstable

**Possible Hazardous Reactions:** None listed.

**Conditions to Avoid:** Avoid generating dust.

**Incompatible Materials:** Halogens, metals, combustible materials, oxidizing materials, metal carbide.

**Fire/Explosion Information:** See Section 5, "Fire Fighting Measures".

**Hazardous Decomposition:** Thermal decomposition will produce oxides of chromium.

**Hazardous Polymerization:**            Will Occur       X   Will Not Occur

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## 11. TOXICOLOGICAL INFORMATION

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**Route of Exposure:**       X   Inhalation       X   Skin            Ingestion

**Symptoms Related to the Physical, Chemical and Toxicological Characteristics:** Exposure may cause irritation and allergic reactions.

**Potential Health Effects (Acute, Chronic and Delayed):**

**Inhalation:** Acute: irritation, allergic reactions, chest pain; chronic: same as acute, lung damage, kidney damage, and liver damage.

**Skin Contact:** Acute and chronic: irritation and allergic reactions.

**Eye Contact:** Acute: irritation; chronic: no information available.

**Ingestion:** Acute: nausea, diarrhea, vomiting; chronic: no information available.

**Numerical Measures of Toxicity:**

**Acute Toxicity:** Not classified; no data available.

**Skin Corrosion/Irritation:** Not classified; no data available.

**Serious Eye damage/Eye irritation:** Not classified; no data available.

**Respiratory Sensitization:** Not classified; no data available.

**Skin Sensitization:** Not classified; no data available.

**Germ Cell Mutagenicity:** Not classified; no data available.

**Carcinogenicity:** Not classified.

**Listed as a Carcinogen/Potential Carcinogen**            Yes       X   No

Chromium (III) compounds are listed by IARC as Group 3 (*not classifiable*). Chromium oxide is not listed by NTP or OSHA as a carcinogen.

**Reproductive Toxicity:** Not classified; no data available.

**Specific Target Organ Toxicity, Single Exposure:** Not classified; no data available.

**Specific Target Organ Toxicity, Repeated Exposure:** Not classified; no data available.

**Aspiration Hazard:** Not classified; no data available.

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## 12. ECOLOGICAL INFORMATION

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**Ecotoxicity Data:** No data available.

**Persistence and Degradability:** No data available.

**Bioaccumulative Potential:** No data available.

**Mobility in Soil:** No data available.

**Other Adverse effects:** No data available.

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## 13. DISPOSAL CONSIDERATIONS

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**Waste Disposal:** Dispose of waste in accordance with all applicable federal, state, and local regulations.

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## 14. TRANSPORTATION INFORMATION

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**U.S. DOT and IATA:** Not regulated by DOT or IATA.

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## 15. REGULATORY INFORMATION

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**U.S. Regulations:**

CERCLA Sections 102a/103 (40 CFR 302.4): Not regulated.

SARA Title III Section 302 (40 CFR 355.30): Not regulated.

SARA Title III Section 304 (40 CFR 355.40): Not regulated.



SARA Title III Section 313 (40 CFR 372.65): 1.0 % de minimis concentration; Chemical Category N090, (related to Chromium(III) compounds).

OSHA Process Safety (29 CFR 1910.119): Not regulated.

SARA Title III Sections 311/312 Hazardous Categories (40 CFR 370.21):

ACUTE HEALTH: No.  
CHRONIC HEALTH: No.  
FIRE: No.  
REACTIVE: No.  
PRESSURE: No.

**State Regulations:**

California Proposition 65: Not listed.

**U.S. TSCA Inventory:** Listed.

**TSCA 12(b), Export Notification:** Not listed.

**Canadian Regulations:**

WHMIS Information: Not provided for this material.

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## 16. OTHER INFORMATION

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**Issue Date:** 10 October 2017

**Sources:** ChemAdvisor, Inc., MSDS *Chromium(III) Oxide*, 09 December 2015.

**Key of Acronyms:**

ACGIH	American Conference of Governmental Industrial Hygienists	NIOSH	National Institute for Occupational Safety and Health
ALI	Annual Limit on Intake	NIST	National Institute of Standards and Technology
CAS	Chemical Abstracts Service	NRC	Nuclear Regulatory Commission
CEN	European Committee for Standardization	NTP	National Toxicology Program
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act	OSHA	Occupational Safety and Health Administration
CFR	Code of Federal Regulations	PEL	Permissible Exposure Limit
CPSU	Coal Mine Dust Personal Sample Unit	RCRA	Resource Conservation and Recovery Act
DOT	Department of Transportation	REL	Recommended Exposure Limit
EC50	Effective Concentration, 50 %	RM	Reference Material
EINECS	European Inventory of Existing Commercial Chemical Substances	RQ	Reportable Quantity
EPCRA	Emergency Planning and Community Right-to-Know Act	RTECS	Registry of Toxic Effects of Chemical Substances
IARC	International Agency for Research on Cancer	SARA	Superfund Amendments and Reauthorization Act
IATA	International Air Transport Association	SCBA	Self-Contained Breathing Apparatus
IDLH	Immediately Dangerous to Life and Health	SRM	Standard Reference Material
ISO	International Organization for Standardization	STEL	Short Term Exposure Limit
LC50	Lethal Concentration, 50 %	TDLo	Toxic Dose Low
LD50	Lethal Dose, 50 %	TLV	Threshold Limit Value
LEL	Lower Explosive Limit	TPQ	Threshold Planning Quantity
MSDS	Material Safety Data Sheet	TSCA	Toxic Substances Control Act
NFPA	National Fire Protection Association	TWA	Time Weighted Average
MSHA	Mine Safety and Health Administration	UEL	Upper Explosive Limit
		WHMIS	Workplace Hazardous Materials Information System

**Disclaimer:** Physical and chemical data contained in this SDS are provided only for use in assessing the hazardous nature of the material. The SDS was prepared carefully, using current references; however, NIST does not certify the data in the SDS. The certified values for this material are given in the NIST Certificate of Analysis.

Users of this SRM should ensure that the SDS in their possession is current. This can be accomplished by contacting the SRM Program: telephone (301) 975-2200; fax (301) 948-3730; e-mail [srmmsds@nist.gov](mailto:srmmsds@nist.gov); or via the Internet at <http://www.nist.gov/srm>.

## SAFETY DATA SHEET

### 1. SUBSTANCE AND SOURCE IDENTIFICATION

#### Product Identifier

**SRM Number:** 674b  
**SRM Name:** X-Ray Powder Diffraction Intensity Set (Quantitative Powder Diffraction Standard)  
**SRM Part:** X-Ray Powder Diffraction Intensity Set CeO<sub>2</sub> (Cerium Oxide)  
**Other Means of Identification:** Not applicable.

#### Recommended Use of This Material and Restrictions of Use

This Standard Reference Material (SRM) is intended primarily for use as internal standards for quantitative X-ray diffraction analysis. A unit of SRM 674b consists of four bottles containing approximately 10 g of each oxide powder (ZnO, TiO<sub>2</sub>, Cr<sub>2</sub>O<sub>3</sub>, and CeO<sub>2</sub>), bottled in an argon atmosphere.

#### Company Information

National Institute of Standards and Technology  
 Standard Reference Materials Program  
 100 Bureau Drive, Stop 2300  
 Gaithersburg, Maryland 20899-2300

Telephone: 301-975-2200  
 FAX: 301-948-3730  
 E-mail: SRMMSDS@nist.gov  
 Website: <http://www.nist.gov/srm>

Emergency Telephone ChemTrec:  
 1-800-424-9300 (North America)  
 +1-703-527-3887 (International)

### 2. HAZARDS IDENTIFICATION

**Note:** This SDS is for CeO<sub>2</sub>; see additional SDSs for the classification for ZnO, TiO<sub>2</sub>, and Cr<sub>2</sub>O<sub>3</sub>.

#### Classification

**Physical Hazard:** Not classified.  
**Health Hazard:** Acute Toxicity, Oral Category 4  
 Acute Toxicity, Inhalation Category 4

#### Label Elements

##### Symbol



##### Signal Word

WARNING

##### Hazard Statement(s):

H302 Harmful if swallowed.  
 H332 Harmful if inhaled.

##### Precautionary Statement(s):

P261 Avoid breathing dust.  
 P264 Wash hands thoroughly.  
 P270 Do not eat, drink or smoke when using this product.  
 P271 Use in a well-ventilated area.  
 P301+P312 If swallowed: Call a doctor if you feel unwell.  
 P330 Rinse mouth.

P304+P340 If inhaled: Remove person to fresh air and keep comfortable for breathing.  
P312 If inhaled: Call a doctor if you feel unwell.  
P501 Dispose of contents and container in accordance with local regulations.

**Hazards Not Otherwise Classified:** Not applicable.

**Ingredients(s) with Unknown Acute Toxicity:** Not applicable.

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### 3. COMPOSITION AND INFORMATION ON HAZARDOUS INGREDIENTS

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**Substance:** Cerium Oxide

**Other Designations:** Cerium (IV) oxide; cerium dioxide; ceria; cerium oxide; CeO<sub>2</sub>; ceric oxide

Components are listed in compliance with OSHA's 29 CFR 1910.1200; for the actual values see the NIST Certificate of Analysis.

Hazardous Component(s)	CAS Number	EC Number (EINECS)	Nominal Mass Concentration (%)
Cerium Oxide	1306-38-3	215-150-4	100

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### 4. FIRST AID MEASURES

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**Description of First Aid Measures:**

**Inhalation:** If adverse effects occur, remove to uncontaminated area. If not breathing, give artificial respiration or oxygen by qualified personnel. Seek immediate medical attention.

**Skin Contact:** Wash skin with soap and water for at least 15 minutes. Thoroughly clean and dry contaminated clothing before reuse.

**Eye Contact:** Flush eyes with water for at least 15 minutes. If necessary, seek medical attention.

**Ingestion:** If a large amount is swallowed, get medical attention.

**Most Important Symptoms/Effects, Acute and Delayed:** May cause irritation, nausea, headache, lung damage.

**Indication of any immediate medical attention and special treatment needed, if necessary:** If any of the above symptoms are present, seek medical attention if needed.

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### 5. FIRE FIGHTING MEASURES

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**Fire and Explosion Hazards:** Negligible fire hazard. See Section 9, "Physical and Chemical Properties" for flammability properties.

**Extinguishing Media:**

Suitable: Use extinguishing agents appropriate for surrounding fire.

Unsuitable: None listed.

**Specific Hazards Arising from the Chemical:** None listed.

**Special Protective Equipment and Precautions for Fire-Fighters:** Avoid inhalation of material or combustion byproducts. Wear full protective clothing and NIOSH approved self-contained breathing apparatus (SCBA).

**NFPA Ratings** (0 = Minimal; 1 = Slight; 2 = Moderate; 3 = Serious; 4 = Severe)

Health = 1                      Fire = 0                      Reactivity = 0

---

### 6. ACCIDENTAL RELEASE MEASURES

---

**Personal Precautions, Protective Equipment and Emergency Procedures:** Use suitable protective equipment; see Section 8, "Exposure Controls and Personal Protection".

**Methods and Materials for Containment and Clean up:** Collect spilled material in appropriate container for disposal. Avoid generating dust. Clean up residue with a high-efficiency particulate filter vacuum.

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## 7. HANDLING AND STORAGE

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**Safe Handling Precautions:** Minimize dust generation. See Section 8, “Exposure Controls and Personal Protection”.

**Storage:** It is recommended that the unused portion of the powder be stored in a tightly capped container such as the original bottle or in a manner to protect against humidity. Store and handling in accordance with all current regulations and standards. Keep separated from incompatible substances (See Section 10, “Stability and Reactivity”).

---

## 8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

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**Exposure Limits:** This material is a particulate matter and adequate inhalation/respiratory protection should be used to minimize exposure. No occupational exposure limits have been established for cerium oxide. The exposure limits for Particulates Not Otherwise Regulated are applicable.

OSHA (PEL): 15 mg/m<sup>3</sup> (TWA, total particulates not otherwise regulated)  
5 mg/m<sup>3</sup> (TWA, respirable particulates not otherwise regulated)

**Engineering Controls:** Provide local exhaust or process enclosure ventilation system. Ensure compliance with applicable exposure limits.

**Personal Protection:** In accordance with OSHA 29 CFR 1910.132, subpart I, wear appropriate Personal Protective Equipment (PPE) to minimize exposure to this material.

**Respiratory Protection:** If workplace conditions warrant a respirator, a respiratory protection program that meets OSHA 29CFR 1910.134 must be followed. Refer to NIOSH 42 CFR 84 for applicable certified respirators.

**Eye/Face Protection:** Wear splash resistant safety goggles with a face shield. An eye wash station should be readily available near areas of use.

**Skin and 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. Chemical-resistant gloves should be worn at all times when handling chemicals.

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## 9. PHYSICAL AND CHEMICAL PROPERTIES

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### Descriptive Properties:

<b>Appearance</b> (physical state, color, etc.):	white or yellow, powder
<b>Molecular Formula:</b>	CeO <sub>2</sub>
<b>Molar Mass (g/mol):</b>	172.12
<b>Odor:</b>	not available
<b>Odor threshold:</b>	not available
<b>pH (solution):</b>	not available
<b>Evaporation rate:</b>	not applicable
<b>Melting point/freezing point (°C):</b>	2600 (4712 °F)
<b>Relative Density</b> as specific gravity (water = 1):	7.132 at 23 °C
<b>Vapor Pressure (mmHg):</b>	not available
<b>Vapor Density (air = 1):</b>	not available
<b>Viscosity (cP):</b>	not available
<b>Solubility(ies):</b>	water: insoluble; soluble in sulfuric acid, nitric acid; insoluble in dilute acids
<b>Partition coefficient (n-octanol/water):</b>	not available
<b>Particle Size:</b>	not available

**Thermal Stability Properties:**

<b>Autoignition Temperature (°C):</b>	not applicable
<b>Thermal Decomposition (°C):</b>	not available
<b>Initial boiling point and boiling range (°C):</b>	not applicable
<b>Explosive Limits, LEL (Volume %):</b>	not applicable
<b>Explosive Limits, UEL (Volume %):</b>	not applicable
<b>Flash Point (°C):</b>	not applicable
<b>Flammability (solid, gas):</b>	not available

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**10. STABILITY AND REACTIVITY**

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**Reactivity:** Stable at normal temperatures and pressure.

**Stability:**       X       Stable                Unstable

**Possible Hazardous Reactions:** None listed.

**Conditions to Avoid:** Avoid generating dust.

**Incompatible Materials:** No data available.

**Fire/Explosion Information:** See Section 5, "Fire Fighting Measures".

**Hazardous Decomposition:** Thermal decomposition will produce oxides of cerium.

**Hazardous Polymerization:**            Will Occur       X   Will Not Occur

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**11. TOXICOLOGICAL INFORMATION**

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**Route of Exposure:**       X   Inhalation       X   Skin       X   Ingestion

**Symptoms Related to the Physical, Chemical and Toxicological Characteristics:** Exposure may cause irritation, nausea, headache, lung damage.

**Potential Health Effects (Acute, Chronic and Delayed):**

**Inhalation:** Acute: nausea, headache, lung damage; chronic: itching, sensitivity to heat, and lung damage.

**Skin Contact:** Acute: hair loss; chronic: no information available.

**Eye Contact:** Acute: irritation and eye damage; chronic: no information available.

**Ingestion:** Acute and chronic: no information available.

**Numerical Measures of Toxicity:**

**Acute Toxicity:** Category 4, Oral; Category 4, Inhalation.

Rat, Oral LD50: >1000 mg/kg

Rat, Inhalation LC50: >2.01 mg/L (4 h)

Rat, Dermal LD50: >2000 mg/kg

**Skin Corrosion/Irritation:** Not classified.

**Serious Eye damage/Eye irritation:** Not classified.

**Respiratory Sensitization:** Not classified; no data available.

**Skin Sensitization:** Not classified; no data available.

**Germ Cell Mutagenicity:** Not classified; no data available.

**Carcinogenicity:** Not classified.

**Listed as a Carcinogen/Potential Carcinogen**            Yes       X   No

Cerium oxide is not listed by IARC, NTP or OSHA as a carcinogen.

**Reproductive Toxicity:** Not classified; no data available.

**Specific Target Organ Toxicity, Single Exposure:** Not classified; no data available.

**Specific Target Organ Toxicity, Repeated Exposure:** Not classified; no data available.

**Aspiration Hazard:** Not classified; no data available.

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## 12. ECOLOGICAL INFORMATION

---

**Ecotoxicity Data:** No data available.

**Persistence and Degradability:** No data available.

**Bioaccumulative Potential:** No data available.

**Mobility in Soil:** No data available.

**Other Adverse effects:** No data available.

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## 13. DISPOSAL CONSIDERATIONS

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**Waste Disposal:** Dispose of waste in accordance with all applicable federal, state, and local regulations.

---

## 14. TRANSPORTATION INFORMATION

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**U.S. DOT and IATA:** Not regulated by DOT or IATA.

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## 15. REGULATORY INFORMATION

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### U.S. Regulations:

CERCLA Sections 102a/103 (40 CFR 302.4): Not regulated.

SARA Title III Section 302 (40 CFR 355.30): Not regulated.

SARA Title III Section 304 (40 CFR 355.40): Not regulated.

SARA Title III Section 313 (40 CFR 372.65): Not regulated.

OSHA Process Safety (29 CFR 1910.119): Not regulated.

SARA Title III Sections 311/312 Hazardous Categories (40 CFR 370.21):

ACUTE HEALTH:	Yes.
CHRONIC HEALTH:	No.
FIRE:	No.
REACTIVE:	No.
PRESSURE:	No.

### State Regulations:

California Proposition 65: Not listed.

**U.S. TSCA Inventory:** Listed.

**TSCA 12(b), Export Notification:** Not listed.

### Canadian Regulations:

WHMIS Information: Not provided for this material.

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## 16. OTHER INFORMATION

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**Issue Date:** 10 October 2017

**Sources:** ChemAdvisor, Inc., MSDS *Ceric Oxide*, 09 December 2015.

CDC; NIOSH; NIOSH Pocket Guide to Chemical Hazards; Department of Health and Human Services (DHHS), Centers for Disease Control and Prevention (CDC), National Institute for Safety and Health; *Particulates Not Otherwise Regulated*, 4 May 2011; available at <http://www.cdc.gov/niosh/npg/npgd0480.html> (accessed Oct 2017).

**Key of Acronyms:**

ACGIH	American Conference of Governmental Industrial Hygienists	NIOSH	National Institute for Occupational Safety and Health
ALI	Annual Limit on Intake	NIST	National Institute of Standards and Technology
CAS	Chemical Abstracts Service	NRC	Nuclear Regulatory Commission
CEN	European Committee for Standardization	NTP	National Toxicology Program
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act	OSHA	Occupational Safety and Health Administration
CFR	Code of Federal Regulations	PEL	Permissible Exposure Limit
CPSU	Coal Mine Dust Personal Sample Unit	RCRA	Resource Conservation and Recovery Act
DOT	Department of Transportation	REL	Recommended Exposure Limit
EC50	Effective Concentration, 50 %	RM	Reference Material
EINECS	European Inventory of Existing Commercial Chemical Substances	RQ	Reportable Quantity
EPCRA	Emergency Planning and Community Right-to-Know Act	RTECS	Registry of Toxic Effects of Chemical Substances
IARC	International Agency for Research on Cancer	SARA	Superfund Amendments and Reauthorization Act
IATA	International Air Transport Association	SCBA	Self-Contained Breathing Apparatus
IDLH	Immediately Dangerous to Life and Health	SRM	Standard Reference Material
ISO	International Organization for Standardization	STEL	Short Term Exposure Limit
LC50	Lethal Concentration, 50 %	TDLo	Toxic Dose Low
LD50	Lethal Dose, 50 %	TLV	Threshold Limit Value
LEL	Lower Explosive Limit	TPQ	Threshold Planning Quantity
MSDS	Material Safety Data Sheet	TSCA	Toxic Substances Control Act
NFPA	National Fire Protection Association	TWA	Time Weighted Average
MSHA	Mine Safety and Health Administration	UEL	Upper Explosive Limit
		WHMIS	Workplace Hazardous Materials Information System

**Disclaimer:** Physical and chemical data contained in this SDS are provided only for use in assessing the hazardous nature of the material. The SDS was prepared carefully, using current references; however, NIST does not certify the data in the SDS. The certified values for this material are given in the NIST Certificate of Analysis.

Users of this SRM should ensure that the SDS in their possession is current. This can be accomplished by contacting the SRM Program: telephone (301) 975-2200; fax (301) 948-3730; e-mail [srmmsds@nist.gov](mailto:srmmsds@nist.gov); or via the Internet at <http://www.nist.gov/srm>.