

SAFETY DATA SHEET

1. SUBSTANCE AND SOURCE IDENTIFICATION

Product Identifier**SRM Number:** 1982**SRM Name:** Thermal Spray Powder – Particle Size Distribution
Yttria-Stabilized Zirconia (Spheroidal)**Other Means of Identification:** Not applicable.**Recommended Use of This Material and Restrictions of Use**

This Standard Reference Material (SRM) is primarily intended for use in the calibration of equipment used to measure particle size distributions (PSD) in the 10 µm to 150 µm range. A unit of SRM 1982 consists of a single bottle containing approximately 10 g of yttria stabilized zirconia (YSZ) powder.

Company Information

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2. HAZARDS IDENTIFICATION

Note: SRM 1982 is supplied in a small quantity and under normal laboratory conditions it does not constitute a combustible dust hazard. The physical properties of this material indicate that accumulated dust on surfaces generated where operations produce fine particulates, may lead to combustible dust concentrations in air.

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: Yttria stabilized zirconia (YSZ) powder**Other Designations:** Zirconia (Zirconium oxide; zirconium dioxide; zirconium white)
Yttria (Diyttrium trioxide; yttrium oxide; yttrium sesquioxide; yttrium(3+) oxide)
Hafnium oxide (Hafnia, hafnium dioxide)

Components are listed in compliance with OSHA's 29 CFR 1910.1200.

Hazardous Component(s)	CAS Number	EC Number (EINECS)	Nominal Mass Concentration (%)
Zirconium oxide	1314-23-4	215-227-2	>90
Yttrium oxide	1314-36-9	215-233-5	7.33
Hafnium oxide	12055-23-1	235-013-2	1.39

4. FIRST AID MEASURES

Description of First Aid Measures

Inhalation: If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing. Get immediate medical attention.

Skin Contact: Wash skin with soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention, if needed. Thoroughly clean and dry contaminated clothing and shoes before reuse.

Eye Contact: Flush eyes with plenty of water for at least 15 minutes. Then get immediate medical attention.

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

Most Important Symptoms/Effects, Acute and Delayed: Exposure may irritate the eyes, skin, respiratory system, and mucous membranes.

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

5. FIRE FIGHTING MEASURES

Fire and Explosion Hazards: Negligible fire hazard. Avoid generating dust; sufficient concentrations of fine dust dispersed in air, and in the presence of an ignition source is a potential 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: Not applicable.

Special Protective Equipment and Precautions for Fire-Fighters: Move container from fire area if it can be done without personal risk. Avoid inhalation of material or combustion by-products. 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: Any accumulated material on surfaces should be removed and properly disposed of. 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.

7. HANDLING AND STORAGE

Safe Handling Precautions: Minimize dust generation and accumulation on surfaces. Use suitable personal protection equipment (PPE). See Section 8, "Exposure Controls and Personal Protection".

Storage and Incompatible Materials: Store and handle 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

Exposure Limits			
Component(s)	OSHA (PEL)	ACGIH (TLV)	NIOSH (REL)
Zirconium Oxide as Zr (related to Zirconium compounds)	TWA: 5 mg/m ³	TWA: 50 mg/m ³ STEL: 10 mg/m ³	TWA: 5 mg/m ³ STEL: 10 mg/m ³ IDLH: 25 mg/m ³ (except Zirconium tetrachloride)
Yttrium Oxide as Y (related to Yttrium compounds)	No occupational exposure limits established	TWA: 1 mg/m ³	TWA: 1 mg/m ³ IDLH: 500 mg/m ³
Hafnium Oxide as Hf (related to Hafnium compounds)	No occupational exposure limits established	TWA: 0.5 mg/m ³	TWA: 0.5 mg/m ³ IDLH: 50 mg/m ³

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

Personal Protection Measures: In accordance with OSHA 29 CFR 1910.132, subpart I, wear appropriate 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 Protection: Splash resistant safety goggles and emergency eyewash are recommended.

Skin and Body Protection: Chemical resistant clothing and gloves are recommended.

9. PHYSICAL AND CHEMICAL PROPERTIES

Descriptive Properties	YSZ powder
Molar Mass (g/mol)	varies
Molecular Formula	not applicable
Appearance (physical state, color, etc.)	fine powder
Odor	odorless
Odor threshold	not available
pH	not available
Evaporation rate	not available
Melting point/freezing point	not available
Relative Density as Specific Gravity (water = 1)	5.8 ^(a)
Vapor Pressure	not available
Vapor Density (air = 1)	not available
Viscosity	not available
Solubilities	insoluble in water
Partition coefficient (n-octanol/water)	not available
Thermal Stability Properties	
Autoignition Temperature	not available
Thermal Decomposition	not available
Initial boiling point and boiling range	not available
Explosive Limits, LEL (Volume %)	not available
Explosive Limits, UEL (Volume %)	not available
Flash Point (Closed Cup)	not available
Flammability (solid, gas)	not available

^(a) Vendor supplied health and safety information.

10. STABILITY AND REACTIVITY

Reactivity: Stable at normal temperatures and pressure.

Stability: Stable Unstable

Possible Hazardous Reactions: Not applicable.

Conditions to Avoid: Avoid heat, flames, sparks, and other ignition sources. Avoid contact with incompatible materials.

Incompatible Materials: Oxidizing materials.

Hazardous Decomposition: Miscellaneous decomposition products.

Hazardous Polymerization: Will Occur Will Not Occur

11. TOXICOLOGICAL INFORMATION

Route of Exposure: Inhalation Skin Ingestion

Symptoms Related to the Physical, Chemical and Toxicological Characteristics: Exposure may irritate the eyes, skin, respiratory system, and mucous membranes.

Potential Health Effects (Acute, Chronic, and Delayed)

Inhalation: Inhalation exposure to zirconia in animals resulted in no detectable effects. Acute inhalation of yttria, a rare earth, has caused sensitivity to heat and itching. Prolonged exposure to rare earth oxides has resulted in transient chemical pneumonitis, subacute bronchitis and bronchiolitis. Hafnia may be irritating to mucous membranes; liver damage may occur.

Skin Contact: Acute and chronic exposure of zirconia to abraded skin may cause allergic granuloma formation. Application of yttria and hafnia may cause irritation.

Eye Contact: Rare earths may irritate the conjunctiva.

Ingestion: Zirconia and rare earths are poorly absorbed by the gastrointestinal tract. Hafnia ingestion may cause liver damage.

Numerical Measures of Toxicity

Acute Toxicity: Not classified.

Zirconium oxide: Mouse, Oral LD50: >8.8 g/kg

Yttrium oxide: Rat, Oral LD50: >10 g/kg

Hafnium oxide: No data available.

Skin Corrosion/Irritation: Not classified.

Zirconium oxide: Rabbit, Dermal: not irritating.

Hafnium compounds may cause mild irritation.

Serious Eye Damage/Irritation: Not classified.

Hafnium compounds may cause mild irritation.

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 No

Zirconium oxide, yttrium oxide, and hafnium oxide are not listed by OSHA, IARC, or NTP as a carcinogen/potential 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 applicable.

12. ECOLOGICAL INFORMATION

Ecotoxicity Data: No data available.

Persistence and Degradability: No data available.

Bioaccumulative Potential: Zirconium oxide (no bioaccumulation expected); yttrium oxide (BCF 1.3 to 54, low to moderate).

Mobility in Soil: No data available.

Other Adverse effects: No data available.

13. DISPOSAL CONSIDERATIONS

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

14. TRANSPORTATION INFORMATION

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

15. REGULATORY INFORMATION

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: No

FIRE: No

REACTIVE: No

PRESSURE: No

State Regulations

California Proposition 65: Not listed.

U.S. TSCA Inventory: Zirconium oxide, yttrium oxide, and hafnium oxide are listed.

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

Canadian Regulations: WHMIS Information is not provided for this material.

16. OTHER INFORMATION

Issue Date: 16 September 2016

Sources: ChemADVISOR, Inc., SDS *Zirconium Oxide*, 09 December 2015.

ChemADVISOR, Inc., SDS *Yttrium Oxide*, 09 December 2015.

ChemADVISOR, Inc., SDS *Hafnium Oxide*, 09 December 2015.

Metallurgical Technologies, Inc, Vendor MSDS, *Metec 1081 Ytria stabilized zirconia 7 % Yttrium oxide*, 01 July 1988.

Hazardous Substances Data Bank (HSDB), National Library of Medicine's TOXNET system, *Zirconium Compounds; Hafnium Compounds; Yttrium Compounds*; available at <http://toxnet.nlm.nih.gov> (accessed Sep 2016).

ESIS, IUCLID Dataset, *Zirconium Dioxide CAS No. 1314-23-4*; available at <https://echa.europa.eu/> (accessed Sep 2016).

ChemIDplus; National Library of Medicine's TOXNET system, *Ytria CAS No.1314-36-9*; available at <http://toxnet.nlm.nih.gov> (accessed Sep 2016).

Key of Acronyms:

ACGIH	American Conference of Governmental Industrial Hygienists	NTP	National Toxicology Program
CAS	Chemical Abstracts Service	OSHA	Occupational Safety and Health Administration
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act	PEL	Permissible Exposure Limit
CFR	Code of Federal Regulations	RCRA	Resource Conservation and Recovery Act
DOT	Department of Transportation	REL	Recommended Exposure Limit
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
LC50	Lethal Concentration	STOT	Specific Target Organ Toxicity
LD50	Median Lethal Dose or Lethal Dose, 50 %	STEL	Short Term Exposure Limit
LEL	Lower Explosive Limit	TLV	Threshold Limit Value
MSDS	Material Safety Data Sheet	TPQ	Threshold Planning Quantity
NFPA	National Fire Protection Association	TSCA	Toxic Substances Control Act
NIOSH	National Institute for Occupational Safety and Health	TWA	Time Weighted Average
NIST	National Institute of Standards and Technology	UEL	Upper Explosive Limit
n.o.s.	Not Otherwise Specified	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 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; or via the Internet at <http://www.nist.gov/srm>.