Safety Data Sheet

National Institute of Advanced Industrial Science and Technology
AIST

1. Identification of the Substance/Mixture and the Supplier

Supplier	:	National Institute of Advanced Industrial Science and Technology (AIST)
Address	:	1-3-1, Kasumigaseki, Chiyoda, Tokyo, Japan
Office in Charge	:	Reference Materials Office, Center for Quality Management of Metrology, National Metrology Institute of Japan
Person in Charge	:	Certified Reference Material Staff
Telephone No.	:	+81-29-861-4059 Fax No. : +81-29-861-4009
Emergency Contact	:	Same as above
		Prepared on : April 22, 2013
		Revised on : March 31, 2017
		ID Number : 5605001
Identity of Substance/Mixture	:	Certified reference material: NMIJ CRM 5605-a Hafnium oxide film for quantitative analysis of Hf
Recommended Use of the Chemical and Restriction on Use	:	This reference material can be used for quality control of quantitative analysis of hafnium in hafnium oxide film by using Rutherford backscattering spectrometry (RBS), inductively-coupled plasma mass spectrometry (ICP-MS), X-ray fluorescence spectrometry, etc. and for validation of the measurement methods. Do not use this reference material for other purposes than testing/research.

2. Hazards Identification

GHS Classification:	Not classifiable
GHS Label Element:	－
Signal Word:	－
Other Hazards Statement:	Harmful if inhaled or swallowed. Cause irritation if in contact with eyes and mucous membrane. May cause such symptoms as discomfort, nausea and headache through prolonged exposure.
Precautionary Statement:	［Precaution］ Use personal protective equipment for hand when handling. ［Action］ If swallowed: Give plenty of water and induce vomiting. Get medical advice/attention if there are any problems. ［Storage］ Protect from direct sunlight. Store in a clean indoor area at room temperature. It is recommended to use desiccator etc. to store in dry air ambience or in nitrogen ambience. ［Disposal］ Entrust disposal of this reference material to a professional waste disposal company licensed by prefectural governor.

The other hazards than the above do not result in classification or are not classifiable.

3. Composition/Information on Ingredients

Substance/Mixture	:	Substance
Concentration (Content)	:	99 % or more
Chemical Formula or Structural Formula	:	Si
Molecuar Weight	:	28.09
Reference Number in Gazetted List in Japan	:	Act on the Evaluation of Chemical Substances and Regulation of Their Manufacture, etc. : - Industrial Safety and Health Act : -
CAS Number	:	7440-21-3

※Contains the following element:

Hafnium (Hf): about 3.6 μg in ultrathin hafnium oxide film

4. First-aid Measures

If inhaled	:	Remove victim to fresh air and keep at rest. Get medical advice/attention.
If on skin	:	Rinse thoroughly with clean water. Get medical advice/attention if inflammation occurs.
If in eyes	:	Rinse thoroughly with clean water. Get medical advice/attention.
If swallowed	:	Give plenty of water and induce vomiting. Get medical advice/attention if there are any problems.
Expected Acute and Delayed Symptom	:	Cause irritation if in contact with eyes and mucous membrane.
Most Critical Characteristic and Symptom	:	—
Protection of First-Aid Responder	:	—

5. Fire-fighting Measures

Extinguishing Media	:	Use dry chemical extinguisher and dry sand. Do not use water or water-type extinguishing media.
Fire-Specific Hazards	:	Combustible if in powder form. May cause dust explosion. If in powder form, it reacts with water to release combustible or explosive gases. Incombustible if in block form.
Specific Fire-Fighting Method	:	Eliminate ignition sources at the origin of a fire and put out fire by using extinguishing media. Remove movable containers promptly to a safe place. In the case of immovable containers, cool their surroundings with sprayed water.
Protection of	:	Carry out fire-fighting from the windward in order to avoid

Fire-Fighters	breathing hazardous gas. Use personal protective equipment such as fireproof clothing, heat-resistant clothing, protective clothing, compressed air open-circuit self-contained breathing apparatus, compressed oxygen closed-circuit self-contained breathing apparatus, rubber gloves and rubber boots.

6. Accidental Release Measures

Personal Precaution Personal Protective Equipment and Emergency Procedures	:	Remove potential ignition sources from the vicinity promptly. Get fire-fighting kit ready to be prepared for ignition. Ventilate the affected areas thoroughly, if it is in an indoor environment, until the clean-up operation is completed. Use appropriate personal protective equipment during the operation to avoid skin contact of splash etc. and inhalation of dust and gas.
Environmental Precautions	:	Take precautions to prevent spillage from draining into rivers etc. to adversely impact the environment. Make it sure to appropriately treat contaminated wastewater in order to prevent untreated wastewater from being released into the surrounding environment.
Recovery and Neutralization	:	Collect scattered fractions in containers which can be tightly closed.
Prevention of Secondary Disaster	:	－

7. Handling and Storage

Handling

Engineering Precautions	:	Nothing special. Use local ventilation system in indoor handling area.
Precautions for Safe Handling	:	Avoid rough handling such as turning over, dropping, giving a shock to or dragging containers. Combustible if in powder form. If in powder form, it reacts with water to release combustible or explosive gases. Take appropriate precautions. Keep container tightly closed after use. Wash hands, face etc. thoroughly and gargle after handling this reference material. Do not bring gloves and other contaminated personal protective equipment into staff room. Make a place handling this reference material a restricted area to keep out unauthorized people. Use appropriate personal protective equipment to avoid inhalation and contact with eyes, skin and clothing.

Storage

Appropriate Storage Conditions	:	Protect from direct sunlight. Store in a clean environment at room temperature. It is recommended to use desiccator etc. to store in dry air ambience or in nitrogen ambience.

Engineering Precautions	:	Nothing special
Incompatible Materials	:	No data available
Safe Container Packaging Material	:	Glass, etc.

8. Exposure Controls/Personal Protection

Threshold Limit Value

Not specified

Permissible Concentration (Si)

・ACGIH TLV-TWA	:	TWA 10 mg/m^3
・Value recommended by Japan Society for Occupational Health (1998)	:	2 mg/m^3 (Respirable fraction) 8 mg/m^3 (Total dust)
・OSHA PEL TWA	:	8H TWA 15 mg/m^3 (Total dust) 8H TWA 5 mg/m^3 (Respirable fraction)

Engineering Controls

Ventilation/Exhaust	:	Local ventilation system or General ventilation system
Storage Precaution	:	Protect from direct sunlight. Store in a dry place at room temperature.

Personal Protective Equipment (PPE)

Respiratory System	:	Dust mask (If dust is generated)
Hands	:	Protective gloves
Eyes	:	Eye protector
Skin and Body	:	Protective clothing, Face protection

9. Physical and Chemical Properties

・Appearance, etc.	:	Solid
・Color	:	Dark blue black
・Odor	:	No data
・pH	:	No data
・Melting point	:	1410 °C
・Boiling point	:	2355 °C
・Flashing point	:	No data
・Explosive range	:	No data
・Vapor pressure	:	No data
・Relative vapor density(Air=1)	:	No data
・Specific gravity or bulk specific gravity	:	2.33 g/cm^3
・Solubility	:	Soluble in aqua regia, nitric acid containing hydrogen fluoride and sodium hydroxide
・*n*-Octanol/water partition coefficient (Log Po/w)	:	No data

・Auto-ignition temperature : No data

10. Stability and Reactivity

◇Chemical Stability
- ・Stable under normal conditions

◇Reactivity
- ・Reacts with oxygen at 400 °C or more and with nitrogen at 1000 °C or more to produce silicon (di)oxide and silicon nitride, respectively.
- ・Reacts with water at high temperature to release explosive hydrogen gas.
- ・Soluble in aqua regia, nitric acid containing hydrogen fluoride and sodium hydroxide.

◇Conditions to Avoid
- ・Sunlight, Heat, Moisture

◇Incompatible Materials
- ・No data available

◇Hazardous Decomposition Products
- ・No data available

11. Toxicological Information

Acute Toxicity	Oral Rat LD50 3160 mg/kg (RTECS)
	Abdominal cavity Rat LDLo 500 mg/kg (RTECS)
Serious Eye Damage/ Eye Irritation	Eye irritation Rabbit 3 mg Mild (RTECS)

12. Ecological Information

Ecotoxicity
- ・No data available

Persistence and Degradability
- ・No data available

Bioaccumulative Potential
- ・No data available

Mobility in Soil
- ・No data available

13. Disposal Considerations

Residual Waste	:	Landfill Dispose of this reference material in accordance with applicable legislation and local government ordinance. When the above-mentioned treatments are not possible, entrust disposal of residual waste to a professional waste disposal company licensed by prefectural governor.
Contaminated Container and Package	:	Dispose of containers after thoroughly emptying them.

14. Transport Information

UN Number	:	1346
UN Classification	:	Class 4.1
Shipping Name	:	Silicon
Packing Group	:	PG Ⅲ
Marine Pollutant	:	Not applicable
Precautions	:	Transport this reference material carefully while keeping it away from direct sunlight and fire and preventing accidental release due to falling, overturning, etc.

15. Regulatory Information

◇Fire Service Act

Article 2: Dangerous Goods, Class 2: Metal Powder (Except for those in which what passes through a wire sieve with aperture of 150 μm accounts for less than 50%)

◇Civil Aeronautics Act

Enforcement Order: Article 194, Dangerous Goods Publication Appendix 4: Combustible Solids (H-Rating 3)

◇Ship Safety Law

Dangerous Goods Rule Article 3: Dangerous Goods Rating 4.1: Combustible Substances (Container Group 3)

16. Other Information

Others

The information in this document is not intended to be exhaustive and is based on currently available information and data. The measures given in this document are applicable only to normal handling conditions. When handling this reference material under special conditions etc., it is recommended to take safety measures appropriate to each specific application and context of use. This document is intended to provide information and not intended to guarantee anything in handling this reference material.