

Safety Data Sheet



1. Identification of the Substance/Mixture and the Supplier

Supplier : The National Institute of Advanced Industrial Science and Technology
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 Department : Reference Material Office, Center for Quality Management of Metrology, The National Metrology Institute of Japan
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 Emergency Contact : Same as above

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Identity of Substance/Mixture : Certified reference material: NMIJ CRM 5204-b
 Ultrathin Silicon dioxide film
 Recommended Use of the Chemical and Restriction on Use : This reference material can be used for calibration, quality control and validation of equipment for in-depth analysis and film thickness measurement. 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 : May cause incised wound at the edge of this reference material.
 If broken, its scattered fractions or dust may get into eyes.
 Precautionary Statement : [Precaution]
 See "7. Handling and Storage Precautions."
 [Action]
 If swallowed: Do not induce vomiting. Get medical advice/attention.
 [Storage]
 See "7. Handling and Storage Precautions."
 [Disposal]
 Entrust disposal of this reference material/containers 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
Content	:	99 % or more (Silicon)
Chemical Formula or Structural Formula	:	Si
Molecular 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

※ On the surface, however, silicon dioxide (Chemical formula: SiO₂, Molecular weight: 60.08, CAS Number: 7631-86-9) with thickness of 3.49 nm is deposited.

4. First-aid Measures

If inhaled	:	This reference material is a square flake of about 15 mm x 15 mm in size. There is limited risk of inhalation in normal conditions of use as a reference material. May be harmful, however, if scattered fractions, dust, mist, etc. generated when this reference material is broken or cut/ground etc. are inhaled. In such a case, remove victim to fresh air and keep at rest in a position comfortable for breathing. Get medical advice/attention as necessary.
If on skin	:	There is no problem in normal conditions of use as a reference material. If symptoms occur, however, get medical advice/attention as necessary.
If in eyes	:	If this reference material is broken and its scattered fractions or dust get into eyes: Rinse thoroughly with clean water. Get medical advice/attention as necessary.
If swallowed	:	Do not induce vomiting. Get medical advice/attention.
Expected Acute and Delayed Symptom	:	This reference material is a square flake of about 15 mm x 15 mm in size. There is no problem in normal conditions of use as a reference material. If dust, mist, etc. generated when it is broken or when it is cut/ground etc. are in contact with eyes/mucous membrane, however, irritation will occur.
Most Critical Characteristic and Symptom	:	—
Protection of First-Aid Responder	:	Use personal protective equipment.

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 Fire-Fighters : Carry out fire-fighting from the windward in order to avoid 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 : Remove potential ignition sources from the vicinity promptly.
- Personal Protective Equipment and Emergency Procedures : 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
- How to take out a sample : Wash tools such as tweezers thoroughly in advance. Take out a sample in as clean environment as possible such as in clean booth.
 - How to return a sample : It is recommended to immediately return a sample back into ultrapure water after measurement. Return a sample in as clean environment as possible such as in clean booth in order to prevent contamination sources from getting into containers.
 - How to judge surface contamination : Surface is hydrophilic when it is clean. If a sample is exposed to the ambience air and gets contaminated, its surface may become hydrophobic to ultrapure water. When the surface starts featuring hydrophobicity, the adsorbed contaminant layer grows around sub-nm in thickness. Thickness of the contaminated layer

which starts to become hydrophobic may be determined by the type of adsorbed gases. Effects of the surface contamination on the measurement are varied, depending on measurement methods. It is necessary, therefore, to decide the maximum permissible surface contamination layer thickness for each measurement method.

- How to address surface contamination : Contaminated surface of a sample may be turned back to hydrophilic clean surface by means of cleaning. Immersion into ultrapure water may be effective in removing minor surface contamination. Ozone water cleaning is more effective in removing surface contamination, and “UV ray + ozone gas” cleaning is more effective than the ozone water cleaning. Cleaning with organic solvents such as acetone and IPA may not be effective enough in turning sample surface from hydrophobic to hydrophilic. On top of that, if the organic solvents remain on the cleaned surface, measured values may be adversely affected.

Local and General Ventilation : 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.
 - Prevent spill, overflow and scattering, and avoid vapor generation.
 - 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.
 - Use appropriate personal protective equipment to avoid inhalation and contact with eyes, skin and clothing.

Storage

Engineering Precautions

- How to store a sample : A sample is stored in ultrapure water which does not contain antimicrobial agent. Storage in a cool dark place, therefore, is desirable in order to suppress growth of bacteria induced by contamination sources. It is also recommended to store this reference material at temperature of 10 °C or less and replace ultrapure water about once a month in order to prevent fluoride ion concentration in ultrapure water from rising.

Appropriate Storage Conditions : Protect from direct sunlight. Avoid contact with the air. Store in a light-shielded clean place at temperature of 10 °C or less.

Incompatible Materials : No data available

Safe Container : Fluoro-resin container

Packaging Material

8. Exposure Controls/Personal Protection

Threshold Limit Value

Not specified

Permissible Concentration (Si)

- ACGIH TLV-TWA : TWA 10 mg/m³
- Value recommended by Japan Society for Occupational Health (1998) : 2 mg/m³ (Respirable fraction)
8 mg/m³ (Total dust)
- OSHA PEL TWA : 8H TWA 15 mg/m³ (Total dust)
8H TWA 5 mg/m³ (Respirable fraction)

Permissible Concentration (SiO₂)

- ACGIH TLV(s) : TWA 0.1 mg/m³
- Value recommended by Japan Society for Occupational Health : Not specified
- OSHA PEL : 8H TWA 10 mg/m³ (% Respirable SiO₂)

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 gray
- Odor : Odorless
- pH : No data available
- Melting point : 1410 °C (Silicon)
- Boiling point : 2355 °C (Silicon)
- 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/cm³ (Silicon)
- 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) (Silicon)
	Abdominal cavity Rat LDLo 500 mg/kg (RTECS) (Silicon)
	Inhalation Rat LC: >200 gm/m ³ /1H (RTECS) (Silicon dioxide)
	Intratracheal Rat TDLo: 1 mg/kg (RTECS) (Silicon dioxide)
Serious Eye Damage/ Eye Irritation	Eye irritation Rabbit 3 mg Mild (RTECS)
Carcinogenicity	IARC Group 3 (Not classifiable as to carcinogenicity to humans) (Silicon dioxide)

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	: Dispose of containers after thoroughly emptying them.

Package

14. Transport Information

UN Number : 1346
UN : Glass 4.1
Classification
Shipping Name : Silicon
Packing Group : PG III
Marine : Not applicable
Pollutant
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

- Not applicable
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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.
