1. Identification

Material name
TEOS

Issue date
26-June-2014

Revision date
27-April-2023

Supersedes date
27-April-2017

Other means of identification
Spec ID 000000000322
CAS number 78-10-4

Recommended use
Semiconductor manufacturing.

Recommended restrictions
None known.

Supplier information
FUJIFILM Electronic Materials U.S.A., Inc.
80 Circuit Drive
North Kingstown RI 02852

Transportation Emergency:
FOR ALL TRANSPORTATION ACCIDENTS, CALL CHEMTREC: 1-800-424-9300

Medical Emergency (24HR):
FOR ANY HEALTH & MEDICAL EMERGENCY, 24 HOURS /7 DAYS CALL: 1-800-365-8951

Non-emergency Telephone:
FOR ALL SDS REQUESTS & QUESTIONS, CALL CUSTOMER SERVICE: 1-800-553-6546

SDS file
10447_US_EN_V3.0

Replaces file
10447_US_EN_V2.0

2. Hazard(s) identification

Physical hazards
Flammable liquids Category 3

Health hazards
Acute toxicity, inhalation Category 4
Serious eye damage/eye irritation Category 2A
Specific target organ toxicity, single exposure Category 3 respiratory tract irritation

OSHA defined hazards
Not classified.

Label elements

Signal word
Warning

Hazard statement
Flammable liquid and vapor. Harmful if inhaled. Causes serious eye irritation. May cause respiratory irritation.

Precautionary statement

Prevention
Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Keep container tightly closed. Ground/bond container and receiving equipment. Use explosion-proof electrical/ventilating/lighting equipment. Use only non-sparking tools. Take precautionary measures against static discharge. Wear protective gloves/protective clothing/eye protection/face protection. Avoid breathing mist/vapors/spray. Use only outdoors or in a well-ventilated area. Wash thoroughly after handling.

Response
If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention. In case of fire: Use alcohol resistant foam, carbon dioxide, dry powder or water fog to extinguish. If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower. If inhaled: Remove person to fresh air and keep comfortable for breathing. Call a poison center/doctor if you feel unwell. In case of fire: Use alcohol-resistant foam, carbon dioxide, dry powder or water fog for extinction.

Storage
Store in a well-ventilated place. Keep cool. Keep container tightly closed. Store locked up.

Disposal
Dispose of contents/container in accordance with local/regional/national/international regulations.
Hazard(s) not otherwise classified (HNOC) None known.

Supplemental information None.

3. Composition/information on ingredients

<table>
<thead>
<tr>
<th>Substance</th>
<th>Chemical name</th>
<th>Common name and synonyms</th>
<th>CAS number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tetraethyl orthosilicate</td>
<td></td>
<td>78-10-4</td>
<td>99 - 100</td>
</tr>
</tbody>
</table>

Composition comments All concentrations are in percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

4. First-aid measures

Inhalation Move injured person into fresh air and keep person calm under observation. Get medical attention immediately.

Skin contact Remove contaminated clothes and rinse skin thoroughly with water for at least 15 minutes. Get medical attention promptly if symptoms persist or occur after washing.

Eye contact Immediately flush with plenty of water for up to 15 minutes. Remove any contact lenses and open eyelids wide apart. Get medical attention if irritation persists after washing.

Ingestion Rinse mouth thoroughly with water and give large amounts of milk or water, if person is conscious. Only induce vomiting at the instruction of medical personnel. Get medical attention if any discomfort continues.

Most important symptoms/effects, acute and delayed Inhalation: Vapors may cause drowsiness and dizziness. Cough. Headache. Sore throat. Eye contact: Causes redness and pain. Skin contact: Dry skin. Redness. Ingestion may cause dizziness, nausea and vomiting.

Indication of immediate medical attention and special treatment needed Treat symptomatically.

General information Thermal burns: Flush with water immediately. While flushing, remove clothes which do not adhere to affected area. Call an ambulance. Continue flushing during transport to hospital.

5. Fire-fighting measures

Suitable extinguishing media The product is flammable, and heating may generate vapors which may form explosive vapor/air mixtures. Extinguish with alcohol-resistant foam, carbon dioxide or dry powder.

Unsuitable extinguishing media Do not use water jet as an extinguisher, as this will spread the fire.

Specific hazards arising from the chemical During fire, gases hazardous to health may be formed. Solvent vapors may form explosive mixtures with air.

Special protective equipment and precautions for firefighters Selection of respiratory protection for firefighting: follow the general fire precautions indicated in the workplace. Self-contained breathing apparatus and full protective clothing must be worn in case of fire.

Fire fighting equipment/instructions Use standard firefighting procedures and consider the hazards of other involved materials. Containers close to fire should be removed or cooled with water.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures Extinguish all ignition sources. Avoid sparks, flames, heat and smoking. Ventilate the area. Avoid inhalation of vapors/mist and contact with skin and eyes. Wear approved protective clothing. See Section 8 of the SDS for Personal Protective Equipment.

Methods and materials for containment and cleaning up Remove sources of ignition. Absorb spillage with non-combustible, absorbent material. For waste disposal, see Section 13 of the SDS.

Environmental precautions Avoid discharge into drains, water courses or onto the ground unless authorized by permit.

7. Handling and storage

Precautions for safe handling Local exhaust is recommended. Avoid inhalation of vapors and spray mist and contact with skin and eyes. Wear approved safety goggles. Wear protective gloves and appropriate clothing to prevent skin contact. The product is flammable, and heating may generate vapors which may form explosive vapor/air mixtures. Do not smoke and do not spray near an open flame or other sources of ignition. Vapors are heavier than air and may travel along the floor and in the bottom of containers. Vapors may be ignited by a spark, a hot surface or an ember. Take precautionary measures against static discharges. Observe good industrial hygiene practices.

Conditions for safe storage, including any incompatibilities Follow rules for flammable liquids. Keep away from heat, sparks and open flame. Do not store near heat sources or expose to high temperatures. Store in closed original container in a dry place. Protect against direct sunlight. Store away from incompatible materials.
8. Exposure controls/personal protection

Occupational exposure limits

US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000)

<table>
<thead>
<tr>
<th>Material</th>
<th>Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tetraethyl orthosilicate</td>
<td>PEL</td>
<td>850 mg/m³</td>
</tr>
<tr>
<td>(CAS 78-10-4)</td>
<td></td>
<td>100 ppm</td>
</tr>
</tbody>
</table>

US. ACGIH Threshold Limit Values

<table>
<thead>
<tr>
<th>Material</th>
<th>Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tetraethyl orthosilicate</td>
<td>TWA</td>
<td>10 ppm</td>
</tr>
<tr>
<td>(CAS 78-10-4)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

US. NIOSH: Pocket Guide to Chemical Hazards

<table>
<thead>
<tr>
<th>Material</th>
<th>Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tetraethyl orthosilicate</td>
<td>TWA</td>
<td>85 mg/m³</td>
</tr>
<tr>
<td>(CAS 78-10-4)</td>
<td></td>
<td>10 ppm</td>
</tr>
</tbody>
</table>

Biological limit values
No biological exposure limits noted for the ingredient(s).

Appropriate engineering controls
Use explosion-proof equipment. Provide adequate ventilation. Observe Occupational Exposure Limits and minimize the risk of inhalation of vapors. Provide easy access to water supply or an emergency shower.

Individual protection measures, such as personal protective equipment

Eye/face protection
Wear approved safety goggles.

Skin protection

Hand protection
Wear protective gloves impervious to the chemicals in use.

Other
Also wear appropriate clothing to prevent any possibility of skin contact. Suitable items can be recommended by the protective equipment supplier or by a qualified industrial hygienist.

Respiratory protection
If engineering controls do not maintain airborne concentrations below recommended exposure limits (where applicable) or to an acceptable level (in countries where exposure limits have not been established), an approved respirator must be worn. In the United States of America, if respirators are used, a program should be instituted to assure compliance with OSHA Standard 1910.134. Use a NIOSH/MSHA approved air purifying respirator as needed to control exposure. Consult with respirator manufacturer to determine respirator selection, use, and limitations. Use positive pressure, air-supplied respirator for uncontrolled releases or when air purifying respirator limitations may be exceeded. Follow respirator protection program requirements (OSHA 1910.134 and ANSI Z88.2) for all respirator use.

Thermal hazards
Wear appropriate thermal protective clothing, when necessary.

General hygiene considerations
Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.

9. Physical and chemical properties

Appearance

Physical state
Liquid.

Form
Liquid.

Color
Colorless.

Odor
Faint.

Odor threshold
85 ppm

pH
Not applicable.

Melting point/freezing point
-115.6 °F (-82 °C)

Initial boiling point and boiling range
332.6 °F (167 °C)

Flash point
127.4 °F (53 °C) Closed Cup

Evaporation rate
< 1 (n-Butyl acetate = 1)

Flammability (solid, gas)
Not applicable.

Upper/lower flammability or explosive limits

Explosive limit - lower (%)
1.3%

Explosive limit - upper (%)
23%

Vapor pressure
1 mm Hg (20°C)
Vapor density 7.22 (Air = 1)
Relative density 0.94 (25°C)
Solubility(ies)
   Solubility (water) Insoluble, decomposes.
Partition coefficient (n-octanol/water) No data available.
Auto-ignition temperature 446 °F (230 °C)
Decomposition temperature No data available.
Viscosity 0.69 mm2/s
Other information
   Density 0.94 g/cc (25°C)
   Molecular weight 208.3 g/mol
   Percent volatile 100 %

10. Stability and reactivity
Reactivity Stable at normal conditions.
Chemical stability Stable under normal temperature conditions.
Possibility of hazardous reactions Will not occur.
Conditions to avoid Heat, sparks, flames. Protect against direct sunlight.
Contact with water liberates ethanol.
Hazardous decomposition products At elevated temperatures: Carbon dioxide. Carbon monoxide. Silicon oxides.

11. Toxicological information
Information on likely routes of exposure
   Inhalation Harmful if inhaled. May cause respiratory irritation. In high concentrations, vapors are narcotic and may cause headache, fatigue, dizziness and nausea. May cause lung edema.
   Skin contact May cause skin irritation. May be absorbed through the skin.
   Eye contact Causes serious eye irritation.
   Ingestion May cause discomfort if swallowed.
Symptoms related to the physical, chemical and toxicological characteristics
   Inhalation: Vapors may cause drowsiness and dizziness. Cough. Headache. Sore throat. Eye contact: Causes redness and pain. Skin contact: Dry skin. Redness. Ingestion may cause dizziness, nausea and vomiting.
Information on toxicological effects
Acute toxicity Harmful if inhaled.

<table>
<thead>
<tr>
<th>Product</th>
<th>Species</th>
<th>Test Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tetraethyl orthosilicate (CAS 78-10-4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Acute</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dermal</td>
<td>Rabbit</td>
<td>&gt; 2000 mg/kg</td>
</tr>
<tr>
<td>LD50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inhalation</td>
<td>Rat</td>
<td>&gt; 880 ppm</td>
</tr>
<tr>
<td>LD50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oral</td>
<td>Rat</td>
<td>6270 mg/kg</td>
</tr>
<tr>
<td>LD50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skin corrosion/irritation</td>
<td></td>
<td>May cause skin irritation.</td>
</tr>
<tr>
<td>Serious eye damage/eye irritation</td>
<td></td>
<td>Causes serious eye irritation.</td>
</tr>
<tr>
<td>Respiratory or skin sensitization</td>
<td></td>
<td>Due to lack of data the classification is not possible.</td>
</tr>
<tr>
<td>Respiratory sensitization</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skin sensitization</td>
<td>Based on available data, the classification criteria are not met.</td>
<td></td>
</tr>
<tr>
<td>Germ cell mutagenicity</td>
<td>Based on available data, the classification criteria are not met.</td>
<td></td>
</tr>
<tr>
<td>Carcinogenicity</td>
<td>Due to lack of data the classification is not possible.</td>
<td></td>
</tr>
<tr>
<td>IARC Monographs. Overall Evaluation of Carcinogenicity</td>
<td>Not listed.</td>
<td></td>
</tr>
</tbody>
</table>
NTP Report on Carcinogens
Not listed.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1053)
Not listed.

Reproductive toxicity
Based on available data, the classification criteria are not met.

Specific target organ toxicity - single exposure
May cause respiratory irritation.

Specific target organ toxicity - repeated exposure
Due to lack of data the classification is not possible.

Aspiration hazard
Based on available data, the classification criteria are not met.

Chronic effects
Organic solvents may be absorbed into the body by inhalation and cause permanent damage to the nervous system, including the brain. May cause damage to the kidneys. Very high or repeated exposure may cause damage to the liver, lungs and red blood cells.

12. Ecological information

Ecotoxicity
The product is not classified as environmentally hazardous. However, this does not exclude the possibility that large or frequent spills can have a harmful or damaging effect on the environment.

<table>
<thead>
<tr>
<th>Product</th>
<th>Species</th>
<th>Test Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tetraethyl orthosilicate (CAS 78-10-4)</td>
<td>Aquatic</td>
<td></td>
</tr>
<tr>
<td>Algae</td>
<td>IC50</td>
<td>Green algae (Selenastrum capricornutum) 1 - 5 mg/l, 30 days</td>
</tr>
<tr>
<td>Crustacea</td>
<td>EC50</td>
<td>Daphnia 4 mg/l, 15 days</td>
</tr>
</tbody>
</table>

Persistence and degradability
The product is readily biodegradable.

Bioaccumulative potential
Potential to bioaccumulate is low.

Mobility in soil
This organic solvent will evaporate easily from all surfaces.

Other adverse effects
No data available.

13. Disposal considerations

Disposal instructions
Disposal recommendations are based on material as supplied. Disposal must be in accordance with current applicable laws and regulations, and material characteristics at time of disposal.

Hazardous waste code
D001: Waste Flammable material with a flash point <140 °F

Waste from residues / unused products
Dispose of waste and residues in accordance with local authority requirements.

Contaminated packaging
Empty containers should be taken to an approved waste handling site for recycling or disposal.

14. Transport information

DOT

| UN number | UN1292 |
| UN proper shipping name | Tetraethyl silicate |
| Transport hazard class(es) | 3 |
| Class | 3 |
| Subsidiary risk | - |
| Label(s) | 3 |
| Packing group | III |
| Environmental hazards | No |
| Marine pollutant | No |
| Special precautions for user | Read safety instructions, SDS and emergency procedures before handling. This material can be reclassified as a combustible liquid and is considered not regulated by ground transport when packaged in non-bulk packaging (<119 G). This exception is found in 49 CFR 173.150(f). |
| Special provisions | B1, IB3, T2, TP1 |
| Packaging exceptions | 150 |
| Packaging non bulk | 203 |
| Packaging bulk | 242 |
| IATA | UN1292 |
| UN proper shipping name | Tetraethyl silicate |
| Transport hazard class(es) | 3 |
| Class | 3 |
| Subsidiary risk | - |
| Label(s) | Flamm. liquid |
Packing group III
Environmental hazards No
ERG Code 3L
Special precautions for user Read safety instructions, SDS and emergency procedures before handling.

IMDG
UN number UN1292
UN proper shipping name Tetraethyl silicate.
Transport hazard class(es)
  Class 3
  Subsidiary risk -
  Label(s) 3
Packing group III
Environmental hazards Marine pollutant No
EmS F-E, S-D
Special precautions for user Read safety instructions, SDS and emergency procedures before handling.
Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

15. Regulatory information
US federal regulations
This product is hazardous according to OSHA 29 CFR 1910.1200.
TSCA Section 4(a) Final Test Rules & Testing Consent Orders: Not regulated.
TSCA Section 5(e) PMN-Substance Consent Orders: Not regulated.
SARA 311/312 Hazard categories: see Section 2 of the SDS.

Drug Enforcement Administration (DEA). List 1(i), Precursor Chemicals (21 CFR 1310.02(a) and 1310.04(f)(1))
  Not listed.
TSCA Section 5(a)(2) Final Significant New Use Rules (SNURs)(40CFR 721, Subpt. E)
  Not regulated.
TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)
  Not regulated.
Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List
  Not regulated.
CERCLA Hazardous Substances reportable quantity (lbs) (40 CFR 302.4)
  Not listed.

Drug Enforcement Administration (DEA) (21 CFR 1308.11-15)
Not controlled

Inventory status
Country(s) or region Inventory name On inventory (yes/no)*
Australia Australian Inventory of Chemical Substances (AICS) Yes
Canada Domestic Substances List (DSL) Yes
Canada Non-Domestic Substances List (NDSL) No
New Zealand New Zealand Inventory Yes
Philippines Philippine Inventory of Chemicals and Chemical Substances (PICCS) Yes
United States & Puerto Rico Toxic Substances Control Act (TSCA) Inventory Yes

All ingredients are TSCA compliant.
* A “Yes” indicates this product complies with the inventory requirements administered by the governing country(s)

State regulations
US. Massachusetts RTK - Substance List
  Tetraethyl orthosilicate (CAS 78-10-4) Listed.

US. New Jersey Worker and Community Right-to-Know Act
  Tetraethyl orthosilicate (CAS 78-10-4)

US. Pennsylvania Worker and Community Right-to-Know Law
  Tetraethyl orthosilicate (CAS 78-10-4)

US. Rhode Island RTK
  Tetraethyl orthosilicate (CAS 78-10-4) Listed.
California Proposition 65
California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65): This material is not known to contain any chemicals currently listed as carcinogens or reproductive toxins. For more information go to www.P65Warnings.ca.gov.

16. Other information, including date of preparation or last revision

Further information
HMIS® is a registered trade and service mark of the ACA.
G - Safety Glasses, Gloves, Vapor Respirator

HMIS® ratings
Health: 2
Flammability: 2
Physical hazard: 0
Personal protection: G

NFPA ratings
Health: 2
Flammability: 2
Instability: 0

List of abbreviations
LD50: Lethal Dose 50%.
EC50: Effective Concentration 50%.
IC50: Inhibition Concentration 50%.

Disclaimer
THIS SAFETY DATA SHEET (SDS) HAS BEEN PREPARED IN COMPLIANCE WITH THE FEDERAL OSHA HAZARD COMMUNICATION STANDARD, 29 CFR 1910.1200. THE INFORMATION IN THIS SDS SHOULD BE PROVIDED TO ALL WHO WILL USE, HANDLE, STORE, TRANSPORT, OR OTHERWISE BE EXPOSED TO THIS PRODUCT. THIS INFORMATION HAS BEEN PREPARED FOR THE GUIDANCE OF PLANT ENGINEERING, OPERATIONS AND MANAGEMENT AND FOR PERSONS WORKING WITH OR HANDLING THIS PRODUCT. FUJIFILM ELECTRONIC MATERIALS BELIEVES THIS INFORMATION TO BE RELIABLE AND UP TO DATE AS OF THE DATE OF PUBLICATION BUT, MAKES NO WARRANTY THAT IT IS. ADDITIONALLY, IF THIS SDS IS MORE THAN FIVE YEARS OLD, YOU SHOULD CONTACT FUJIFILM ELECTRONIC MATERIALS AT THE PHONE NUMBER 1-800-553-6546 (CUSTOMER SERVICE) TO MAKE CERTAIN THAT THIS DOCUMENT IS CURRENT.

This SDS contains revisions in the following section(s):
1, 2, 5, 6, 10, 14, 15, 16.

SDS file
10447_US_EN_V3.0

Replaces file
10447_US_EN_V2.0