1. Identification

Material name ALUMINUM ETCH 16:1:1:2
Issue date 29-September-2014
Revision date -
Supersedes date -
Other means of identification
Spec ID 100000002073
Synonyms None.
Recommended use Etchant used in 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 10379_US_EN_V1.0
Replaces file None

2. Hazard(s) identification

Physical hazards Corrosive to metals Category 1
Health Hazards Skin corrosion/irritation Category 1B
Serious eye damage/eye irritation Category 1
OSHA defined hazards Not classified.
Label elements

Signal word Danger
Hazard statement May be corrosive to metals. Causes severe skin burns and eye damage.
Precautionary statement
Prevention Wear protective gloves/protective clothing/eye protection/face protection. Do not breathe mist/vapors/spray. Wash thoroughly after handling.
Response If swallowed: Rinse mouth. Do NOT induce vomiting. If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower. Wash contaminated clothing before reuse. If inhaled: Remove person to fresh air and keep comfortable for breathing. If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a poison center/doctor.
Storage Store locked up.
Disposal Dispose of contents/container in accordance with local/regional/national/international regulations.
Hazard(s) not otherwise classified (HNOC) None known.

3. Composition/information on ingredients

Mixture
### Chemicals

<table>
<thead>
<tr>
<th>Chemical name</th>
<th>Common name and synonyms</th>
<th>CAS number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phosphoric acid</td>
<td></td>
<td>7664-38-2</td>
<td>60-80</td>
</tr>
<tr>
<td>Acetic acid</td>
<td></td>
<td>64-19-7</td>
<td>0-10</td>
</tr>
<tr>
<td>Nitric acid</td>
<td></td>
<td>7697-37-2</td>
<td>0-5</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
Immediately remove from further exposure. Get immediate medical assistance. For those providing assistance, avoid exposure to yourself or others. Use adequate respiratory protection. Give supplemental oxygen, if available. If breathing has stopped, assist ventilation with a mechanical device or use mouth-to-mouth resuscitation.

#### Skin contact
Remove contaminated clothes and rinse skin thoroughly with water for at least 15 minutes. Get medical attention immediately. Chemical burns must be treated by a physician.

#### Eye contact
Flush thoroughly with water for at least 15 minutes. Get immediate medical assistance. If medical assistance is not immediately available, flush an additional 15 minutes. Make sure to remove any contact lenses from the eyes before rinsing.

#### Ingestion
Rinse mouth thoroughly with water and give large amounts of milk or water to people not unconscious. Do not induce vomiting. If vomiting occurs, the head should be kept low so that stomach vomit doesn’t enter the lungs. Lay on the side. Obtain medical attention and take along this material safety data sheet.

#### Most important symptoms/effects, acute and delayed
- **Inhalation:** May cause damage to mucous membranes in nose, throat, lungs and bronchial system. Be aware that symptoms of lung edema (shortness of breath) may develop up to 24 hours after exposure. Eye contact: Prolonged contact causes serious eye and tissue damage. Skin contact: May cause serious chemical burns to the skin. Ingestion: May cause burns in mucous membranes, throat, esophagus and stomach.

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

#### General information
Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

### 5. Fire-fighting measures

#### Suitable extinguishing media
Use fire-extinguishing media appropriate for surrounding materials.

#### Unsuitable extinguishing media
None.

#### Specific hazards arising from the chemical
By heating and fire, toxic and corrosive vapors/gases may be formed.

#### 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.

### 6. Accidental release measures

#### Personal precautions, protective equipment and emergency procedures
Avoid any exposure. Wear suitable protective clothing. See Section 8 of the SDS for Personal Protective Equipment.

#### Methods and materials for containment and cleaning up
Absorb spillage with suitable 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
Mechanical ventilation or local exhaust ventilation may be required. Avoid any exposure. Wear approved safety goggles. Wear protective gloves and appropriate clothing to prevent skin contact. Work practice should minimize contact. Observe good industrial hygiene practices.

#### Conditions for safe storage, including any incompatibilities
Store in closed original container in a dry place. 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>Components</th>
<th>Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetic acid (CAS 64-19-7)</td>
<td>PEL</td>
<td>25 mg/m³</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10 ppm</td>
</tr>
<tr>
<td>Nitric acid (CAS 7697-37-2)</td>
<td>PEL</td>
<td>5 mg/m³</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 ppm</td>
</tr>
<tr>
<td>Phosphoric acid (CAS 7664-38-2)</td>
<td>PEL</td>
<td>1 mg/m³</td>
</tr>
</tbody>
</table>

US. ACGIH Threshold Limit Values

<table>
<thead>
<tr>
<th>Components</th>
<th>Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetic acid (CAS 64-19-7)</td>
<td>STEL</td>
<td>15 ppm</td>
</tr>
<tr>
<td></td>
<td>TWA</td>
<td>10 ppm</td>
</tr>
<tr>
<td>Nitric acid (CAS 7697-37-2)</td>
<td>STEL</td>
<td>4 ppm</td>
</tr>
<tr>
<td></td>
<td>TWA</td>
<td>2 ppm</td>
</tr>
<tr>
<td>Phosphoric acid (CAS 7664-38-2)</td>
<td>STEL</td>
<td>3 mg/m³</td>
</tr>
<tr>
<td></td>
<td>TWA</td>
<td>1 mg/m³</td>
</tr>
</tbody>
</table>

US. NIOSH: Pocket Guide to Chemical Hazards

<table>
<thead>
<tr>
<th>Components</th>
<th>Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetic acid (CAS 64-19-7)</td>
<td>STEL</td>
<td>37 mg/m³</td>
</tr>
<tr>
<td></td>
<td>TWA</td>
<td>15 ppm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10 ppm</td>
</tr>
<tr>
<td>Nitric acid (CAS 7697-37-2)</td>
<td>STEL</td>
<td>10 mg/m³</td>
</tr>
<tr>
<td></td>
<td>TWA</td>
<td>4 ppm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 ppm</td>
</tr>
<tr>
<td>Phosphoric acid (CAS 7664-38-2)</td>
<td>STEL</td>
<td>3 mg/m³</td>
</tr>
<tr>
<td></td>
<td>TWA</td>
<td>1 mg/m³</td>
</tr>
</tbody>
</table>

Biological limit values

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

Appropriate engineering controls

Provide adequate ventilation. Observe Occupational Exposure Limits and minimize the risk of inhalation of vapors. Eye wash facilities and emergency shower must be available when handling this product.

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 measures are not sufficient to maintain concentrations of dust particulates below the OEL, suitable respiratory protection 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 to pale yellow.
Odor: Vinegar-like.
Odor threshold: No data available.

pH: < 2 (25 °C)

Melting point/freezing point: No data available.

Initial boiling point and boiling range: 244.4 - 249.8 °F (118 - 121 °C)

Flash point: None.

Evaporation rate: < 1 (Water = 1)

Flammability (solid, gas): Not applicable.

Upper/lower flammability or explosive limits:
- Flammability limit - lower (%): Not applicable.
- Flammability limit - upper (%): Not applicable.

Vapor pressure: No data available.

Vapor density: No data available.

Relative density: 1.5 - 1.7

Solubility(ies):
- Solubility (water): Completely miscible in water.

Partition coefficient (n-octanol/water): No data available.

Auto-ignition temperature: None.

Decomposition temperature: No data available.

Viscosity: No data available.

Other information:
- Density: 1.50 - 1.70 g/cc
- Molecular weight: Not applicable/mixture.
- Percent volatile: 15 - 30 %

10. Stability and reactivity

Chemical stability: Stable under normal temperature conditions.

Possibility of hazardous reactions: Will not occur.

Conditions to avoid: Keep away from heat.

Incompatible materials:
- Strong alkalis.
- Alkalis (organic).
- Alkali metals.
- Metals.
- Strong oxidizing agents.
- Peroxide.
- Amines.
- Bases.
- Alcohols.
- Cyanides.
- Sulfides.
- Glass.
- Silica.

Hazardous decomposition products:

11. Toxicological information

Information on likely routes of exposure:
- Inhalation: Causes respiratory tract burns. High concentrations: May cause lung damage.
- Skin contact: Causes severe skin burns.
- Eye contact: Causes serious eye damage.
- Ingestion: Causes digestive tract burns.

Symptoms related to the physical, chemical and toxicological characteristics:
- Inhalation: May cause damage to mucous membranes in nose, throat, lungs and bronchial system. Be aware that symptoms of lung edema (shortness of breath) may develop up to 24 hours after exposure. Eye contact: Prolonged contact causes serious eye and tissue damage. Skin contact: May cause serious chemical burns to the skin. Ingestion: May cause burns in mucous membranes, throat, esophagus and stomach.

Information on toxicological effects

Acute toxicity:

<table>
<thead>
<tr>
<th>Components</th>
<th>Species</th>
<th>Test Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetic acid (CAS 64-19-7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acute</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dermal</td>
<td>Rabbit</td>
<td>1060 mg/kg</td>
</tr>
</tbody>
</table>
## Test Results

<table>
<thead>
<tr>
<th>Components</th>
<th>Species</th>
<th>Test Results</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rat</strong></td>
<td><strong>Inhalation</strong></td>
<td>11.4 mg/l, 4 Hours</td>
</tr>
<tr>
<td><strong>Oral</strong></td>
<td><strong>LD50</strong></td>
<td>3.31 g/kg</td>
</tr>
</tbody>
</table>

**Nitric acid (CAS 7697-37-2)**

<table>
<thead>
<tr>
<th>Species</th>
<th>Test Results</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Acute</strong></td>
<td><strong>Inhalation</strong></td>
</tr>
<tr>
<td><strong>LD50</strong></td>
<td><strong>Rabbit</strong></td>
</tr>
<tr>
<td><strong>Oral</strong></td>
<td><strong>LD50</strong></td>
</tr>
</tbody>
</table>

**Skin corrosion/irritation**

- Causes severe skin burns.

**Serious eye damage/eye irritation**

- Causes serious eye damage.

**Respiratory or skin sensitization**

- Respiratory sensitization: No data available.
- Skin sensitization: Not a skin sensitizer.
- Germ cell mutagenicity: No data available.
- Carcinogenicity: No data available.


- Not listed.

**Reproductive toxicity**

- No data available.

**Specific target organ toxicity - single exposure**

- No data available.

**Specific target organ toxicity - repeated exposure**

- No data available.

**Aspiration hazard**

- No data available.

**Chronic effects**

- May cause lung damage. Inhalation of vapor or mist may cause lung edema. Erosion of exposed teeth. Exposure to this product is associated with an increased risk of bronchitis.

### 12. Ecological information

**Ecotoxicity**

The product contains a substance which is toxic to aquatic organisms. The product contains a substance which is harmful to aquatic organisms.

<table>
<thead>
<tr>
<th>Components</th>
<th>Species</th>
<th>Test Results</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Acetic acid (CAS 64-19-7)</strong></td>
<td><strong>Aquatic</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Crustacea</strong></td>
<td><strong>EC50</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>LD50</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Fish</strong></td>
<td><strong>LC50</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
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<td><strong>Nitric acid (CAS 7697-37-2)</strong></td>
<td><strong>Aquatic</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Crustacea</strong></td>
<td><strong>LC50</strong></td>
</tr>
<tr>
<td><strong>Phosphoric acid (CAS 7664-38-2)</strong></td>
<td><strong>Aquatic</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Fish</strong></td>
<td><strong>LC50</strong></td>
</tr>
</tbody>
</table>

**Persistence and degradability**

- No data available.

**Bioaccumulative potential**

- No data available.
Bioaccumulative potential
Octanol/water partition coefficient log Kow
Acetic acid (CAS 64-19-7) -0.17

Mobility in soil
No data available.
Mobility in general
The product is miscible with water. May spread in water systems.
Other adverse effects
The product may affect the acidity (pH-factor) in water with risk of harmful effects to aquatic organisms.

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
D002: Waste Corrosive material [pH <=2 or =>12.5, or corrosive to steel]
Waste from residues / unused products
Dispose of in accordance with local regulations.
Contaminated packaging
Empty containers should be taken to an approved waste handling site for recycling or disposal.

14. Transport information
DOT
UN number UN1760
UN proper shipping name Corrosive liquids, n.o.s. (Phosphoric acid, Acetic acid)
Transport hazard class(es)
Class 8
Subsidiary risk -
Label(s) 8
Packing group II
Environmental hazards
Marine pollutant No
Special precautions for user Read safety instructions, SDS and emergency procedures before handling.
Special provisions B2, IB2, T11, TP2, TP27
Packaging exceptions 154
Packaging non bulk 202
Packaging bulk 242

IATA
UN number UN1760
UN proper shipping name Corrosive liquid, n.o.s. (Phosphoric acid, Acetic acid)
Transport hazard class(es)
Class 8
Subsidiary risk -
Label(s) 8
Packing group II
Environmental hazards No
ERG Code 8L
Special precautions for user Read safety instructions, SDS and emergency procedures before handling.

IMDG
UN number UN1760
UN proper shipping name CORROSIVE LIQUID, N.O.S. (Phosphoric acid, Acetic acid)
Transport hazard class(es)
Class 8
Subsidiary risk -
Label(s) 8
Packing group II
Environmental hazards
Marine pollutant No
EmS F-A, S-B
Special precautions for user Read safety instructions, SDS and emergency procedures before handling.
This substance/mixture is not intended to be transported in bulk.

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.
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) (40 CFR 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.

US EPCRA (SARA Title III) Section 302 - Extremely Hazardous Spill: Reportable quantity
Nitric acid (CAS 7697-37-2) 1000 LBS

US EPCRA (SARA Title III) Section 302 - Extremely Hazardous Substance: Threshold Planning Quantity
Nitric acid (CAS 7697-37-2) 1000 LBS

US EPCRA (SARA Title III) Section 313 - Toxic Chemical: De minimis concentration
Nitric acid (CAS 7697-37-2) 1.0 %

US EPCRA (SARA Title III) Section 313 - Toxic Chemical: Listed substance
Nitric acid (CAS 7697-37-2) Listed.

CERCLA (Superfund) reportable quantity (lbs) (40 CFR 302.4)
Phosphoric acid: 5000
Acetic acid: 5000
Nitric acid: 1000

Superfund Amendments and Reauthorization Act of 1986 (SARA)
Hazard categories
Immediate Hazard - Yes
Delayed Hazard - No
Fire Hazard - No
Pressure Hazard - No
Reactivity Hazard - No

Section 302 extremely hazardous substance (40 CFR 355, Appendix A)
No

Section 311/312 (40 CFR 370)
Yes

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

Inventory status

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

All ingredients are TSCA compliant.

*A “Yes” indicates this product complies with the inventory requirements administered by the governing country(s)

State regulations
This product does not contain a chemical known to the State of California to cause cancer, birth defects or other reproductive harm.

US - California Proposition 65 - Carcinogens & Reproductive Toxicity (CRT): Listed substance
Not listed.

US. Massachusetts RTK - Substance List
Acetic acid (CAS 64-19-7) Listed.
Nitric acid (CAS 7697-37-2) Listed.
Phosphoric acid (CAS 7664-38-2) Listed.

US. New Jersey Worker and Community Right-to-Know Act
Acetic acid (CAS 64-19-7)
Nitric acid (CAS 7697-37-2)
Phosphoric acid (CAS 7664-38-2)

US. Pennsylvania Worker and Community Right-to-Know Law
Acetic acid (CAS 64-19-7)
Nitric acid (CAS 7697-37-2)
Phosphoric acid (CAS 7664-38-2)
US. Rhode Island RTK

Acetic acid (CAS 64-19-7) Listed.
Nitric acid (CAS 7697-37-2) Listed.
Phosphoric acid (CAS 7664-38-2) Listed.

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

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

HMIS® ratings
Health: 3
Flammability: 0
Physical hazard: 0
Personal protection: G

NFPA ratings
Health: -
Flammability: -
Instability: -

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 PLANAR SOLUTIONS 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 THREE YEARS OLD, YOU SHOULD CONTACT FUJIFILM PLANAR SOLUTIONS AT THE PHONE NUMBER 1-800-553-6546 (CUSTOMER SERVICE) TO MAKE CERTAIN THAT THIS DOCUMENT IS CURRENT.

SDS file
10379_US_EN_V1.0

Replaces file
None