

1. Identification

Material name	ALUMINUM ETCH 16:1:1:2
Issue date	07-October-2016
Revision date	08-October-2018
Supersedes date	07-October-2016
Other means of identification	
Spec ID	10000002073
Synonyms	Metal etchants, aluminum etchants.
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_V3.0
Replaces file	10379_US_EN_V2.0

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. Keep only in original container.
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. Absorb spillage to prevent material damage.
Storage	Store in corrosive resistant container with a resistant inner liner. 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

Mixture

Chemical name	Common name and synonyms	CAS number	%
Phosphoric acid		7664-38-2	60 - 80
Acetic acid		64-19-7	0,01 - 10
Nitric acid		7697-37-2	0,01 - 5

Composition comments All concentrations are in percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.
The product contains: Water.

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 is 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 in corrosive resistant container with a resistant inner liner. 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)

Components	Type	Value
Acetic acid (CAS 64-19-7)	PEL	25 mg/m3
		10 ppm
Nitric acid (CAS 7697-37-2)	PEL	5 mg/m3
		2 ppm
Phosphoric acid (CAS 7664-38-2)	PEL	1 mg/m3

US. ACGIH Threshold Limit Values

Components	Type	Value
Acetic acid (CAS 64-19-7)	STEL	15 ppm
	TWA	10 ppm
Nitric acid (CAS 7697-37-2)	STEL	4 ppm
	TWA	2 ppm
Phosphoric acid (CAS 7664-38-2)	STEL	3 mg/m3
	TWA	1 mg/m3

US. NIOSH: Pocket Guide to Chemical Hazards

Components	Type	Value
Acetic acid (CAS 64-19-7)	STEL	37 mg/m3
		15 ppm
	TWA	25 mg/m3
		10 ppm
Nitric acid (CAS 7697-37-2)	STEL	10 mg/m3
		4 ppm
	TWA	5 mg/m3
		2 ppm
Phosphoric acid (CAS 7664-38-2)	STEL	3 mg/m3
	TWA	1 mg/m3

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

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. 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.

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 Not applicable.

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 with water.

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

Auto-ignition temperature None.

Decomposition temperature No data available.

Viscosity 15.3 mm²/s (24°C/75°F) (Kinematic)

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 May be corrosive to metals. Reacts with most metals to form flammable hydrogen gas.

Conditions to avoid Contact with metals.

Incompatible materials Strong alkalis. Strong oxidizing agents. Bases. Organic compounds. Metals. Alkali metals. Cyanides. Sulfides.

Hazardous decomposition products At elevated temperatures: Carbon dioxide. Carbon monoxide. Hydrogen. Phosphorus oxides. Acetic acid. Nitrogen oxides.

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

Components	Species	Test Results
Acetic acid (CAS 64-19-7)		
Acute		
Inhalation		
LC50	Rat	11.4 mg/l, 4 Hours
Oral		
LD50	Rat	3310 mg/kg
Nitric acid (CAS 7697-37-2)		
Acute		
Inhalation		
LC50	Rat	> 2.65 mg/l, 4 hours
Phosphoric acid (CAS 7664-38-2)		
Acute		
Dermal		
LD50	Rabbit	2740 mg/kg
Oral		
LC50	Rat	2600 mg/kg (Approximate)
Skin corrosion/irritation	Causes severe skin burns.	
Serious eye damage/eye irritation	Causes serious eye damage.	
Respiratory or skin sensitization		
Respiratory sensitization	Due to lack of data the classification is not possible.	
Skin sensitization	Due to lack of data the classification is not possible.	
Germ cell mutagenicity	Based on available data, the classification criteria are not met.	
Carcinogenicity	Due to lack of data the classification is not possible.	
IARC Monographs. Overall Evaluation of Carcinogenicity	Not listed.	
NTP Report on Carcinogens	Not listed.	
OSHA Specifically Regulated Substances (29 CFR 1910.1001-1053)	Not regulated.	
Reproductive toxicity	Due to lack of data the classification is not possible.	
Specific target organ toxicity - single exposure	Due to lack of data the classification is not possible.	
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	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.	
Further information	Prolonged overexposure to fluorides may increase fluoride content of bones and teeth, and may result in fluorosis, with mottling of teeth (in children) and brittleness of bones.	

12. Ecological information

Components	Species	Test Results
Ecotoxicity	The product contains a substance which is harmful to aquatic organisms.	
Acetic acid (CAS 64-19-7)		
Aquatic		
<i>Acute</i>		
Algae	EC50	Skeletonema costatum > 300.82 mg/l, 72 hours
Crustacea	EC50	Daphnia magna > 1000 mg/l, 48 hours
Fish	LC50	Cyprinodon variegatus > 300.82 mg/l, 96 hours Oncorhynchus mykiss > 300.82 mg/l, 96 hours
Nitric acid (CAS 7697-37-2)		
<i>Acute</i>		
Fish	LC50	Salmo gairdneri 4400 mg/l, 96 hours

Components	Species		Test Results
Aquatic			
Crustacea	EC50	Daphnia magna	490 mg/l, 48 hours
Phosphoric acid (CAS 7664-38-2)			
Aquatic			
Crustacea	EC50	Daphnia magna	> 100 mg/l, 48 hours
Fish	LC50	Oryzias latipes	75.1 mg/l, 96 hours
Persistence and degradability	The product contains inorganic compounds which are not biodegradable.		
Bioaccumulative potential	Not relevant for inorganic substances.		
Octanol/water partition coefficient log Kow			
Acetic acid (CAS 64-19-7)		-0.17	
Mobility in soil	This product is miscible in water and may not disperse in soil.		
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 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	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)	Corrosive
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	-
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.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code Not applicable.

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.

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

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

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.

California Proposition 65

California Safe Drinking Water and Toxic Enforcement Act of 2016 (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.

US. California. Candidate Chemicals List. Safer Consumer Products Regulations (Cal. Code Regs, tit. 22, 69502.3, subd. (a))

Nitric acid (CAS 7697-37-2)

Phosphoric acid (CAS 7664-38-2)

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: 3 Flammability: 0 Physical hazard: 0 Personal protection: G
NFPA ratings	Health: - Flammability: - Instability: -
List of abbreviations	LD50: Lethal Dose, 50%. LC50: Lethal Concentration, 50%. EC50: Effective 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 THREE 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, 7, 10, 11, 12, 14, 15, 16.
SDS file	10379_US_EN_V3.0
Replaces file	10379_US_EN_V2.0