

MATERIAL SAFETY DATA SHEET

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THIS MATERIAL SAFETY DATA SHEET (MSDS) HAS BEEN PREPARED IN COMPLIANCE WITH THE FEDERAL OSHA HAZARD COMMUNICATION STANDARD, 29 CFR 1910.1200. THIS PRODUCT MAY BE CONSIDERED TO BE A HAZARDOUS CHEMICAL UNDER THAT STANDARD. (REFER TO THE OSHA CLASSIFICATION IN SEC. I) THIS INFORMATION IS REQUIRED TO BE DISCLOSED FOR SAFETY IN THE WORK PLACE. THE EXPOSURE TO THE COMMUNITY, IF ANY, IS QUITE DIFFERENT.

I. PRODUCT IDENTIFICATION

PRODUCT NAME: ~~TITANIUM ETCHANT TFTN~~

REVISION DATE: 1/01/97, 2/26/98, 9/01

SYNONYMS: Chlorohydric acid, hydrogen chloride, muriatic acid

CHEMICAL FAMILY: Inorganic acid

FORMULA: HCl

DESCRIPTION: Acid

OSHA HAZARD CLASSIFICATION: Corrosive; eye and skin hazard; lung toxin

II. COMPONENT DATA

PRODUCT COMPOSITION

CAS or CHEMICAL NAME: HYDROCHLORIC ACID MIXTURE

CAS NUMBER: 7647-01-0 (HCL)

PERCENTAGE RANGE: 20-30%

HAZARDOUS PER 29 CFR 1910.1200: Yes

EXPOSURE STANDARDS:

	OSHA (PEL)		ACGIH(TLV)	
	ppm	mg/cubic-meter	ppm	mg/cubic-meter
TWA:	None		None	
CEILING:	5	7	5	7.5
STEL:	None		None	

CAS or CHEMICAL NAME: Water

CAS NUMBER: 7732-18-5

PERCENTAGE RANGE: 60-80%

HAZARDOUS PER 29 CFR 1910.1200: No

EXPOSURE STANDARDS: None Established

HMIS Rating

Health : 2

Reactivity : 0

Flammability : 1

III. PRECAUTIONS FOR SAFE HANDLING AND STORAGE

DO NOT TAKE INTERNALLY. AVOID CONTACT WITH SKIN, EYES AND CLOTHING. UPON

CONTACT WITH SKIN OR EYES, WASH OFF WITH WATER. AVOID BREATHING MIST OR VAPOR.

STORAGE CONDITIONS: Store in cool, clean, well-ventilated area. DO NOT STORE AT TEMPERATURES ABOVE: 38°C (100°F) DO NOT EXPOSE TO DIRECT LIGHT.

PRODUCT STABILITY AND COMPATIBILITY: Stable

SHELF LIFE LIMITATIONS: 1 year

INCOMPATIBLE MATERIALS FOR PACKAGING: Glass or polyethylene containers recommended.

INCOMPATIBLE MATERIALS FOR STORAGE OR TRANSPORT: When shipped with oxidizers, must be separated by 18 inches, with wood pallets and absorbent material in between.

IV. PHYSICAL DATA

APPEARANCE: Clear, colorless liquid

FREEZING POINT: 7% (-2°C (28°F))

37% (-74°C (-101°F))

BOILING POINT: 7-20% (>100-110°C (>212 to 230°F))

20-38% (110-74°C (230 to 167°F))

DECOMPOSITION TEMPERATURE: No Data

SPECIFIC GRAVITY: 1.035-1.188

BULK DENSITY: Not Applicable

pH @ 25°C: < 1

VAPOR PRESSURE @ 20°C: 7-32% (0-23.5 mmHg)

(Partial pressure HCl) 32-38% (23.5-210 mmHg)

SOLUBILITY IN WATER: Complete

VOLATILES, PERCENT BY VOLUME: 100%

EVAPORATION RATE: Approximately 1 (Water = +1)

VAPOR DENSITY: 1.3 (active ingredient)

MOLECULAR WEIGHT: 36.46 (Active ingredient)

ODOR: Pungent, suffocating odor.

COEFFICIENT OF OIL/WATER DISTRIBUTION: No Data

V. PERSONAL PROTECTIVE EQUIPMENT REQUIREMENTS

PERSONAL PROTECTION FOR ROUTINE USE OF PRODUCT

RESPIRATORY PROTECTION: Respirator protection not normally needed. If vapors, mists, or aerosols are generated, wear a NIOSH/MSHA approved respirator.

VENTILATION: Local exhaust ventilation is recommended if vapors, mists or aerosols are generated. Otherwise, use good general room ventilation.

SKIN PROTECTIVE EQUIPMENT: Wear gloves, boots, apron and a face shield with safety glasses. A full impermeable suit is recommended if exposure is possible to large portion of body.

OTHER: Emergency eye wash and safety showers must be provided in the immediate work area.

EQUIPMENT SPECIFICATIONS:

RESPIRATOR TYPE: Full face-piece, NIOSH/MSHA approved equipped with chemical cartridges approved for hydrogen chloride

GLOVE TYPE: Neoprene

BOOT TYPE: Neoprene

APRON TYPE: Neoprene

FACE SHIELD: Yes

PROTECTIVE SUIT: Neoprene

VI. FIRE AND EXPLOSION HAZARD INFORMATION

FLAMMABILITY DATA:

FLAMMABLE: No

COMBUSTIBLE: No

PYROPHORIC: No

FLASH POINT: Not Applicable

AUTOIGNITION TEMPERATURE: Not Applicable

FLAMMABLE LIMITS AT NORMAL ATMOSPHERIC TEMPERATURE AND PRESSURE
(PERCENT VOLUME IN AIR): LEL - Not Applicable UEL - Not Applicable

NFPA RATINGS:

Health: 3

Flammability: 0

Reactivity: 1

HMIS RATINGS:

Health: 3

Flammability: 0

Reactivity: 1

EXTINGUISHING MEDIA: Not Applicable

FIRE FIGHTING TECHNIQUES AND COMMENTS: Use water to cool containers exposed to fire. Contact with reactive metals, e.g., aluminum may result in the generation of flammable hydrogen gas. On small fires, use dry chemical or carbon dioxide. On large fires, use water. Not combustible but contact with common metals produces flammable hydrogen gas. May also release chlorine gas by reaction with oxidizing agents.

VII. REACTIVITY INFORMATION

CONDITIONS UNDER WHICH THIS PRODUCT MAY BE UNSTABLE:

TEMPERATURES ABOVE: No Data

MECHANICAL SHOCK OR IMPACT: No

ELECTRICAL (STATIC) DISCHARGE: No

HAZARDOUS POLYMERIZATION: Will not occur

INCOMPATIBLE MATERIALS: Alkaline materials, aluminum, amines, carbonates, iron, sulfuric acid, hydroxides, leather and other fabrics, metallic oxides, magnesium, oleum, perchloric acid and zinc.

HAZARDOUS DECOMPOSITION PRODUCTS: Flammable hydrogen gas by reaction with many metals. Also, chlorine gas is released by reaction with oxidizing agents.

OTHER CONDITIONS TO AVOID: Heat, exposure to sunlight

SUMMARY OF REACTIVITY:

OXIDIZER: No

PYROPHORIC: No

ORGANIC PEROXIDE: No

WATER REACTIVE: No

CORROSIVE: Yes

VIII. FIRST AID

EYES: Immediately flush with large amounts of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Call a physician at once.

SKIN: Immediately flush with water for at least 15 minutes. Call a physician. If clothing comes in

contact with the product, the clothing should be removed immediately and should be laundered before re-use.

INGESTION: Immediately drink large quantities of water. DO NOT induce vomiting. Call a physician at once. DO NOT give anything by mouth if the person is unconscious or if having convulsions.

INHALATION: If person experiences nausea, headache or dizziness, person should stop work immediately and move to fresh air until these symptoms disappear. If breathing is difficult, administer oxygen, keep the person warm and at rest. Call a physician. In the event that an individual inhales enough vapor to lose consciousness, person should be moved to fresh air at once and a physician should be called immediately. If breathing has stopped, artificial respiration should be given immediately. In all cases, ensure adequate ventilation and provide respiratory protection before the person returns to work.

IX. TOXICOLOGY AND HEALTH INFORMATION

ROUTES OF ABSORPTION: Oral, dermal, inhalation, eye contact

WARNING STATEMENTS AND WARNING PROPERTIES

MAY BE HARMFUL IF SWALLOWED. CAUSES EYE, SKIN, DIGESTIVE TRACT AND RESPIRATORY TRACT BURNS. CAN CAUSE LUNG DAMAGE.

HUMAN DOSE RESPONSE DATA

ODOR THRESHOLD: The odor threshold for concentrated HCl (38%) is 1-5 ppm.

IRRITATION THRESHOLD: Irritation threshold for concentrated HCl has been reported to be 5 ppm or greater.

IMMEDIATELY DANGEROUS TO LIFE OR HEALTH: The IDLH for hydrogen chloride gas is 50 ppm.

SIGNS, SYMPTOMS, AND EFFECTS OF EXPOSURE

INHALATION

ACUTE: Inhalation of the mist or vapor or hydrogen chloride gas may cause irritation of the mucous membranes and respiratory tract with symptoms of burning, choking and coughing. At exposure concentrations greater than the TLV, damage may occur to the mucous membranes (ulceration of the nose and throat) and respiratory tract. At these high concentrations, severe breathing difficulties may occur which may be delayed in onset and may be due to pulmonary edema (fluid in the lung) or laryngeal edema or spasm.

CHRONIC: Repeated or prolonged exposure to concentrations greater than accepted occupational limits may cause dental discoloration and erosion of the teeth.

SKIN

ACUTE: Hydrochloric acid mist may rapidly cause skin inflammation and burns. Direct contact with the liquid will be corrosive to the skin and can cause severe irritation and/or burns characterized by redness, swelling and scab formation. The potential for scarring and ulceration of the contacted tissue also exists.

CHRONIC: Repeated contact with the mist has been reported to cause a contact dermatitis (skin rash). Prolonged or repeated exposure with the liquid may cause permanent damage.

EYE

ACUTE: Exposure to the mist may result in eye irritation and/or severe burns with permanent damage and possible loss of sight. Direct contact with the liquid will be corrosive to the eye with resulting severe burns, potential visual impairment or loss of sight.

INGESTION

ACUTE: Irritation and/or burns can occur to the entire gastrointestinal tract, including the stomach and intestines, characterized by nausea, vomiting, diarrhea, abdominal pain, bleeding, and/or tissue ulceration. Ingestion causes severe damage to the gastrointestinal tract with the potential to cause perforation.

CHRONIC: There are no known or reported effects from chronic exposure. Chronic ingestion of significant amounts of this product is unlikely because of its acute corrosive action.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Respiratory and cardiovascular disease

INTERACTIONS WITH OTHER CHEMICALS WHICH ENHANCE TOXICITY

None known or reported

ANIMAL TOXICOLOGY

ACUTE TOXICITY:

Inhalation LC 50: 3124 ppm/ 1 hour (rat)

Oral LD 50: 900 mg/kg (rabbit)

Dermal LD 50: No Data

Corrosive to skin and eyes; severe respiratory irritant

AQUATIC TOXICITY:

It is the resulting pH rather than the concentration of HCl that governs its lethality to aquatic life.

Only when the pH value is depressed to 5.0 or lower will hydrochloric acid prove lethal to fish.

The 96 hr. LC50 at 20°C for bluegill sunfish occurs when HCl lowers the pH value to 3.6. The 96 hr.

LC50 for mosquito fish (*Gambusia affinis*) in turbid water is a concentration of 282 mg/l of HCl.

100% mortality to trout occurred for a 24 hr. exposure at a concentration of 10 mg/l.

The toxic threshold of HCl toward *Daphnia magna* has been reported to be 56 to 62 mg/l in soft water and Lake Erie water, respectively.

ACUTE TARGET ORGAN TOXICITY:

This product is corrosive to all tissues contacted and upon inhalation, may cause irritation to mucous membranes and respiratory tract.

CHRONIC TARGET ORGAN TOXICITY:

The only known or reported health effects from repeated exposure to hydrochloric acid are described above and are related to tissue damage to dental enamel and gums leading to erosion of the teeth.

These effects would occur from exposures greater than currently accepted occupational limits.

REPRODUCTIVE TOXICITY:

There are no known or reported effects on reproductive function or fetal development.

CARCINOGENICITY:

This product is not known or reported to be carcinogenic by any reference source including IARC, OSHA, NTP or EPA. IARC has classified hydrochloric acid as having inadequate evidence for carcinogenicity to humans and animals. IARC therefore considers hydrochloric acid to be not classifiable as to its carcinogenicity to humans.

The carcinogenesis response to the combined and separate exposures to formaldehyde and hydrochloric acid was investigated in male inbred Sprague-Dawley rats. The rats were exposed to gaseous formaldehyde, 14 ppm and hydrochloric acid, 10 ppm. No carcinogenic response was observed with hydrochloric acid alone.

MUTAGENICITY:

Hydrochloric acid has been tested and was shown to be non-mutagenic in a battery of mutagenicity and genotoxicity assays including the following: Ames assay, Salmonella and Saccharomyces (yeast) microbial assays, L5178Y mouse lymphoma gene mutation assay, sister chromatid exchange assay, and the mammalian chromosomal aberrations assay.

X. TRANSPORTATION INFORMATION

THIS MATERIAL IS REGULATED AS A D.O.T. HAZARDOUS MATERIAL.

D.O.T. DESCRIPTION FROM THE HAZARDOUS MATERIALS TABLE 49 CFR 172.101:

LAND (U.S. DOT): HYDROCHLORIC ACID SOLUTION. 8. UN1789. PG II

WATER (IMO): Same as above
AIR (IATA/ICAO): Same as above
HAZARD LABEL/PLACARD: CORROSIVE
REPORTABLE QUANTITY: 5000 lbs. (Per 49 CFR 172.101, Appendix)
EMERGENCY GUIDE NO: 60
SPECIAL COMMENTS: RQ does not apply to package size.

XI. SPILL AND LEAKAGE PROCEDURES

FOR ALL TRANSPORTATION ACCIDENTS, CALL CHEMTREC AT 800-424-9300.
REPORTABLE QUANTITY: This product is subject to a Reportable Quantity with respect to hydrochloric acid. RQs are subject to change and reference should be made to 40 CFR 302.4 for the current requirements.
SPILL MITIGATION PROCEDURES: Hazardous concentrations in air may be found in local spill area and immediately downwind.
AIR RELEASE: Vapors may be suppressed by the use of a water fog, or vapor suppressant foam. Dike and contain all run-off water for treatment as a hazardous waste.
WATER RELEASE: This material is heavier than and soluble in water. Contain contaminated water by building a dike of compatible absorbents. Vacuum or pump material to a neutralization container and treat.
LAND SPILL: Compatible absorbents: Sand, clay soil and commercial absorbents.
SPILL RESIDUES: Dispose of per guidelines under Section XII. WASTE DISPOSAL.
PERSONAL PROTECTION FOR EMERGENCY SPILL AND FIRE-FIGHTING SITUATIONS:
Response to this material MAY REQUIRE the use of a full encapsulated suit and self-contained breathing apparatus (SCBA).
Additional protective clothing must be worn to prevent personal contact with this material. Those items include but are not limited to boots, gloves, hard hat, splash-proof goggles, full face shield, impervious clothing, i.e., chemically impermeable suit, and self-contained breathing apparatus.
Compatible materials for response to this material are neoprene or butyl rubber.

XII. WASTE DISPOSAL

If this product becomes a waste, it meets the criteria of a hazardous waste as defined under 40 CFR 261 and would have the following EPA hazardous waste number: D002.
If this product becomes a waste, it will be a hazardous waste which is subject to the Land Disposal Restrictions under 40 CFR 268 and must be managed accordingly.
As a hazardous liquid waste, it must be disposed of in accordance with Local, State and Federal regulations in a permitted hazardous waste treatment, storage and disposal facility by treatment.
CARE MUST BE TAKEN TO PREVENT ENVIRONMENTAL CONTAMINATION FROM THE USE OF THIS MATERIAL. THE USER OF THIS MATERIAL HAS THE RESPONSIBILITY TO DISPOSE OF UNUSED MATERIAL, RESIDUES AND CONTAINERS IN COMPLIANCE WITH ALL RELEVANT LOCAL, STATE AND FEDERAL LAWS AND REGULATIONS REGARDING TREATMENT, STORAGE AND DISPOSAL FOR HAZARDOUS AND NON-HAZARDOUS WASTES.

XIII. ADDITIONAL REGULATORY STATUS INFORMATION

TOXIC SUBSTANCES CONTROL ACT: This substance is listed on the Toxic Substances Control Act inventory
NSF LIMITS: NSF Maximum Drinking Water Use Concentration - 40 mg/L as hydrochloric acid
SUPERFUND AMENDMENT AND REAUTHORIZATION ACT, TITLE III:

HAZARD CATEGORIES, PER 40 CFR 370.2:

HEALTH:

Immediate (Acute)

Delayed (Chronic)

PHYSICAL: None

EMERGENCY PLANNING AND COMMUNITY RIGHT TO KNOW, PER 40 CFR 355, APP.A:

EXTREMELY HAZARDOUS SUBSTANCE - THRESHOLD PLANNING QUANTITY:

None Established

SUPPLIER NOTIFICATION REQUIREMENTS, PER 40 CFR 372.45:

This mixture or trade name product contains a toxic chemical or chemicals subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR 372.

CHEMICALS LISTED ARE: Hydrochloric acid

XIV. MAJOR REFERENCES

1. Griffith, J.F., et al., Dose-Response Studies with Chemical Irritation in the Albino Rabbit Eye as a Basis for Selecting Optimum Testing Conditions for Predicting Hazard to the Human Eye. Toxicology and Applied Pharmacology, Vol 55, pp. 501-513, 1980.
2. Toxicological Testing of Selected Hazardous Materials for Transportation Purposes. NTIS PB Report: (P8-270-991), National Technical Information Service, Springfield, VA, April 1976.
3. Isquith, A., et al., Genotoxicity Studies on Selected Organosilicon Compounds: In Vitro Assays. Food and Chemical Toxicology, Vol. 26, No. 3, pp. 255-261, 1988.
4. Sellakumar, Arthur R., et al., Carcinogenicity of Formaldehyde and Hydrogen Chloride in Rats. Toxicology and Applied Pharmacology, Vol. 81, pp. 401-406, 1985.

THE INFORMATION IN THIS MATERIAL SAFETY DATA SHEET 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. TRANSENE BELIEVES THIS INFORMATION TO BE RELIABLE AND UP TO DATE AS OF THE DATE OF PUBLICATION, BUT MAKES NO WARRANTY THAT IT IS.