

METALLOGRAPHIC ETCHANT SAFETY PROCEDURES**LEGAL DISCLAIMER**

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LEGAL DISCLAIMER: CHEMICAL MIXING RECOMMENDATIONS

The information provided herein regarding the mixing of chemicals is for informational purposes only. It does not constitute professional advice and should not be considered as such. The mixing of chemicals can be hazardous and may result in harmful or dangerous reactions, including but not limited to toxic fumes, explosions, fires, and chemical burns.

****No Warranty:**** We make no representations or warranties of any kind, express or implied, about the completeness, accuracy, reliability, suitability, or safety of the information provided. Any reliance you place on such information is strictly at your own risk.

****Assumption of Risk:**** You assume all risks associated with the use or application of any chemical mixing instructions or guidelines provided. It is your responsibility to conduct a thorough risk assessment and to take appropriate safety precautions, including wearing protective equipment and conducting experiments in a controlled environment.

****Liability Limitation:**** To the fullest extent permitted by law, we disclaim any and all liability for any damages, injuries, or adverse outcomes that may result from following any chemical mixing instructions or guidelines provided. This includes, but is not limited to, liability for direct, indirect, incidental, special, consequential, or punitive damages.

****Consult a Professional:**** We strongly advise consulting with a qualified professional, such as a chemist or safety specialist, before attempting to mix any chemicals. Proper training and knowledge are essential for safe chemical handling and experimentation.

****Compliance with Laws and Regulations:**** You are responsible for ensuring that your actions comply with all applicable laws, regulations, and safety standards. This includes proper storage, handling, and disposal of chemicals.

****Acknowledgment of Understanding:**** By using the information provided, you acknowledge that you have read, understood, and agreed to this disclaimer and that you assume full responsibility for any and all outcomes resulting from the use of this information.

STORAGE

-Clearly label all containers

-HF, H₂SiF₆ and HBF₄ storage – these materials react with glass, therefore proper storage should be in polyethylene, polypropylene or similarly inert plastic containers (90).

-Strong alkaline solutions – these materials react with glass, therefore proper storage should be in polyethylene, polypropylene or similarly inert plastic containers (90).

-Phosphoric acid (H₃PO₄) – these materials react with glass, therefore proper storage should be in polyethylene, polypropylene or similarly inert plastic containers (90).

-Perchloric acid (HClO_4) – do not store high concentration of perchloric acid in plastic bottles (91)

DANGEROUS MIXTURES

Review all MSDS before mixing

-*Perchloric acid* in concentrations exceeding 60% are highly flammable and explosive. The danger is greatly increased by the presence of organic materials or metals that oxidize readily. Keep temperature of the solution below 35° C (95° F) and, if necessary, use a coolant bath. Wearing safety glasses is helpful, but working behind a safety shield is preferable.

-*Nital* (methanol/ethanol and HNO_3) can build-up a gaseous reaction product and must be stored in a vented or pressure-relief container.

-*Mixtures of alcohol and hydrochloric acid* can react in various ways to produce aldehydes, fatty acids, explosive nitrogen compounds, etc. The tendency toward explosion increases with increasing molecule size. Hydrochloric acid content should not exceed 5% in ethanol or 35% in methanol. These mixtures should not be stored.

-*Mixtures of phosphoric acid* can result in the formation of ester, some of which are potent nerve poison. If absorbed through the skin or inhaled, severe personal damage may result.

-*Mixtures of methanol and sulfuric acid* may form dimethylene sulfate, an odorless, tasteless compound that may be fatal if absorbed in sufficient quantities into the skin or respiratory tract. Even gas masks do not offer adequate protection. Sulfates of the higher alcohols, however, are not potentially dangerous poisons.

-*Mixtures of chromium (VI) oxide and organic materials* are explosive. Mix with care and do not store.

Lead and lead salts are highly toxic, and the damage produced is cumulative. Care is also recommended when handling cadmium, thallium, nickel, mercury, and other heavy metals.

-*Cyanide compounds (CN)* are highly dangerous because hydrocyanic acid (HCN) may easily form. They are fast-acting poisons that can cause death, even in relatively low concentrations.

-*Hydrofluoric acid* is a very strong skin and respirator poison that is hard to control. It should be handled with extreme care, because sores resulting from its attack on the skin does not heal readily. Hydrofluoric acid also attacks glass, and fumes from specimens etched in HF solution could easily damage front elements of microscope lenses. Specimens should be rinsed thoroughly and in some cases placed in a vacuum desiccator for one to two hours before examination.

-*Picric acid anhydride* is an explosive.

Mixing oxidizing agents with reducing agents. Mixing oxidizing agents, such as HNO_3 , H_2SO_4 , perchloric acid (HClO_4), CrO_3 , salts of these acids, persulfates, Br_2 and H_2O_2 , with reducing agents – for example, alcohols and other organic solvents, acetic acid, acetic anhydride and most organic compounds – requires special care. Mix slowly and stir continuously.

PERSONAL SAFETY

-Wear appropriate eye protection (safety goggles or safety glasses – see MSDS sheets)

-Wear approved rubber gloves and laboratory coats or aprons.

-Mix etchant and etch with adequate and appropriate ventilation (fume hood is generally recommended)

-FIRST AID – Review MSDS sheets for specific medical instructions

SKIN – In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

EYES – Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately

INHALATION – Remove to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

INGESTION: Refer to MSDS sheets for specific guidelines. Never give anything by mouth to an unconscious person. Get medical attention immediately.

MIXING GUIDELINES

-Acids and Bases: ALWAYS mix concentrated acids and bases into water to prevent excessive heat generation.

-Monitor temperature of mixture to prevent overheating

-Mix in well ventilated area

-Use recommended personal safety equipment

DISPOSAL

When appropriate dilute all concentrated chemicals prior to disposal. If regulations allow disposal to sewer, use a substantial amount of running water and slowly add etchant to flow. Continue to purge drain thoroughly with water. Follow all Local, State and Federal Disposal Guidelines.