Use of Nitric Acid & Alcohol Solutions

Overview
Nitric Acid and Alcohol (Nital) solutions are used for the routine etching of metals and for revealing the microstructure of carbon steels. The more general term, Nital, is a mixture of nitric acid and methanol, ethanol or methylated spirits. In addition to nitric acid being very corrosive, it is also very reactive and is an oxidizing agent. When combined with flammable solvents such as alcohols in a concentration greater than 10%, a highly explosive mixture forms, due to the rapid formation of nitrogen dioxide gas (NO₂).

Nitric Acid & Flammable Solvent Waste
Hazardous waste incidents involving nitric acid and flammable solvents have occurred in Carnegie Mellon University laboratories. The common factor was inadvertent mixing of nitric acid and flammable solvent waste, or Nital waste was incorrectly handled and allowed to sit too long. In the latter case, if a 10% nitric acid solution sits for a long time, the alcohol can evaporate over time, thus increasing the nitric acid to a critical concentration. Therefore, to prevent future incidents, those who use Nital, must stabilize the waste by dilution into water immediately after use, as described by the protocol in the following section. Likewise, other nitric acid waste must be kept in a designated nitric acid waste bottle and kept separated from flammable solvent waste to prevent inadvertent combining of wastes.

Nital Solutions are Particularly Hazardous Substances
For the reasons of high reactivity and instability over time, Nital Solutions are treated as OSHA Particularly Hazardous Substances (PHS) and, per Carnegie Mellon Policy, all areas of use must have all PHS controls in place including, but not limited to:
- A written SOP for the work must be prepared by the individual laboratory.
- The Principal Investigator (PI) must approve each employee for use with the PHS, with both parties signing the final sheet of the standard procedure.
- The PHS procedure format is located at http://www.cmu.edu/ehs/chemical/PHSformblank.pdf
- Additional information on PHS use may be found in the Carnegie Mellon Chemical Hygiene Plan.
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Protocol
Handling of Nitric Acid/Alcohol (Nital) Solutions
1. Nital (nitric acid and alcohols) should be used in concentrations no greater than 10% nitric acid by volume.
   a. If you need to use a concentration higher than 10%, please see the lab manager or your PI to ask for permission.
2. Nital should be mixed and then used immediately.
   a. Do not store Nital for future use.
3. Make up no more than 500 ml of Nital per batch.
   a. If you need to make larger batches, contact your lab manager or PI, who will need to make arrangements with EH&S for waste pickup.
4. For disposal, dilute Nital with 2 L of water per 500 ml of Nital solution and store in an appropriate waste container.
   a. Nital can generate fumes while sitting. Dilution is critical to safe storage of waste.
5. Be prompt about arranging for waste pickup of nitric acid solutions. Most lab accidents with Nital occur while the waste is sitting in storage. Once used, diluted, and stored in a waste container, the waste should be tagged and reported for waste pickup immediately.

Storage
Do not store Nitric Acid/Alcohol solutions. Mix fresh solution for each use, preparing only the amount expected for current use and then dilute according to the protocol above for disposal.

Disposal
• Do delay request for collection of aqueous-diluted Nital solutions.
• Always keep a separate designated waste bottle for other Nitric Acid wastes. Store nitric acid waste where it will not be inadvertently combined with flammable solvent waste.

For further information, contact Environmental Health and Safety at the numbers below.

Our Mission:
Environmental Health & Safety (EH&S) is committed to providing health and safety services that protect the University community and the environment.