



Dartmouth College HANOVER • NEW HAMPSHIRE • 03755
37 Dewey Field Rd. • Telephone: (603) 646-1762 • Fax: (603) 646-2622
ENVIRONMENTAL HEALTH AND SAFETY

Standard Operating Procedure for Handling Pyrophoric Materials at Dartmouth College

Minimum Protective Clothing:

- Fire resistant or “FR” lab coat (look for “FR” on label)
- Long pants with closed toe shoes
- Safety glasses or chemical splash goggles
- Two pair 4 mil nitrile gloves (single use disposable give the best dexterity)
- Face Shield is optional
- Nomex/Leather flight gloves are optional but recommended

Minimum Protective Equipment:

- Functioning chemical fume hood
- Access to a working eyewash and safety shower
- Access to a fire extinguisher
- Portable lexan shield (optional as space allows)

Training and Work Practices

- A principle investigator must authorize trained personnel to work with reactive chemicals.
- Training must include observation and direct supervision of work to gain experience with specialized equipment and chemicals.
- Minimum training prerequisites available via the EHS website (www.dartmouth.edu/~ehs): view “Handling Pyrophoric Materials” video, hands on fire extinguisher training, general lab safety program, hazardous waste management web module.
- Never work alone, a co-worker must be present in the lab during liquid transfer
- Work in fume hood at all times, keep the sash as low as possible, remove all unneeded chemical containers, waste bottles and combustibles (paper etc.)
- Use a portable lexan shield as space allows.
- Work in dry/inert glove box can provide superior protection but additional training and instruction specific to glove box operation is required. No lab coat is required when working in a glove box. An FR lab coat is required when the air lock is opened to transfer hazardous chemicals.

Emergency Procedures

- Spills or releases of small amounts of pyrophoric materials may self extinguish in the container or hood bench. If this happens, secure all reaction containers and stop work. Report all spills/fires to EHS and your PI, consult with PI to identify causes/solutions.

- Larger spills and/or fires must be treated as an emergency. If possible close the hood sash, step away from the fume hood and send co-worker to pull the fire alarm. Only fight a fire if the fire alarm has been activated and you have been trained in hands on fire extinguisher use and have your exit path clear.

Technical Notes:

- Transfers of small volumes (1-25 ml) can be performed with glass Luer-lock syringe using dry nitrogen/argon and mineral oil bubbler. Never use plastic syringes for handling pyrophorics.
- Transfers of larger volumes (>50ml) must be performed using a cannula with a Schlenk line or similar nitrogen/argon purged apparatus with mineral oil bubbler.
- Check the MSDS for each pyrophoric to find compatible cooling solvents. In a spill/release acetone and 2-propanol will react violently with certain pyrophoric liquids (i.e. organolithiums). Consider hexane or heptane as alternatives.
- Ensure all systems, glassware, reaction/transfer/sample containers are dried and cooled to room temperature before use.
- Dry and pure Nitrogen or Argon should have no more than 5ppm moisture or oxygen content.
- Argon must be used where lithium metal is a reactant to prevent the formation of lithium nitride.
- Pyrophoricity will vary between chemicals and also based on concentration, age and environmental conditions. Evaporation of carrier solvent can CONCENTRATE pyrophoric solutions and increase the hazard. Always titrate your pyrophoric to determine the concentration before use.
- Reactions with pyrophoric liquids are exothermic, always use larger than normal reaction vessels and provide pressure release on inert systems.

Pyrophoric chemicals are liquids or solids that can ignite spontaneously in air. This includes n-butyl lithium, t-butyl lithium sec-butyllithium, methyllithium, dibutylmagnesium and some phosphines and silanes. Pyrophoric materials can ignite in air via reactions with moisture (i.e. organolithiums) or oxygen (i.e. phosphines). Carrier solvents with low flash points will increase the hazard. Lower concentrations of pyrophoric material in solvent may be classified as "less hazardous" "spontaneously combustible" or "water reactive" materials. Dispersions of water reactive solids in solvents (sodium hydride, borohydrides etc.) and some solid chemicals can exhibit pyrophoric characteristics under humid conditions. "Air reactive" materials may decompose, generate toxic/flammable gases and subsequently ignite. "Water reactive" chemicals may react with liquid water to generate toxic/flammable gasses and heat causing a subsequent fire. "Moisture sensitive" materials are generally least reactive, and may simply decompose or lose desired activity if exposed to moisture.

References:

Sigma Aldrich technical bulletins AL-134 and AL-164
 FMClithium "Organometallics and reactive specialty organics safe handling guide"
 FMClithium "Butyllithium safe handling guide"