



Quenching of Pyrophoric Materials

H250



Examples: tert-Butyllithium, sec-Butyllithium, n-Butyllithium, DiethylZinc, Organoaluminum compounds (as Et₃Al, Et₂AlCl, EtAlCl₂, Me₃Al), Raney Nickel catalyst

WORKING ALONE¹ is PROHIBITED while quenching PYR materials

Areas with blue text indicate that information must be provided or modified by researcher prior to the SOP approval.

This SOP is not a substitute for hands-on training.

Print a copy and insert into your laboratory SOP binder.

Department:	[Chemistry
Date SOP was written:	[11/22/16
Date SOP was approved by PI/lab supervisor:	[
Principal Investigator:	Name: Richmond Sarpong
	Signature: _____
Internal Lab Safety Coordinator or Lab Manager:	Name: Rebecca Johnson/Melissa Hardy
	Lab Phone: 978-886-5808/406-696-1225
	Office Phone: 510-642-6312
Emergency Contact:	Name: Rebecca Johnson/Melissa Hardy
	Phone Number: 978-886-5808/406-696-1225
Location(s) covered by this SOP:	[831,832,834,836,837,838,839,842,844,847,849

1. Purpose

This SOP covers the precautions and safe handling procedures for the Quenching of Pyrophoric Materials.

All materials mentioned in your laboratory “**Pyrophoric Materials**” (PYR) Class SOP are covered by this hazardous operations SOP.

¹ When included in a standard operating procedure, for any duration of time, a person is **working alone** when performing a task in a laboratory and they cannot be seen or heard by other workers, and when assistance is not readily available. In this context, a task is any portion or section of an operation or job, and does not refer to a job in its entirety.



Also, this SOP covers any materials synthesized using pyrophoric liquids or solids.

If you have questions concerning the applicability of any recommendation or requirement listed in this procedure, contact the Principal Investigator/Laboratory Supervisor or the campus Chemical Hygiene Officer at ucbcho@berkeley.edu.

2. Physical & Chemical Properties

For physical and chemical properties on pyrophoric materials, please refer to your laboratory "PYR" SOP and to specific Safety Data Sheets (SDS) of chemicals in use (See Section 11 – SDS Location).

3. Potential Hazards

When exposed to moisture or air, these reagents may ignite spontaneously. When quenching pyrophoric materials, the individual hazards of the pyrophorics and the solvent, as well as the hazard of the mixture, must all be considered, and procedures for safe quenching must reflect this consideration.

As defined by the Globally Harmonized System of Classification and Labeling of Chemicals (GHS), pyrophorics are designated by following H code:

H250 Catches fire spontaneously if expose to air

4. Engineering Controls

The following is the set of engineering controls required when quenching pyrophoric materials:

- Work under an inert atmosphere (e.g., argon, nitrogen) using a Schlenk line, in a glove box, vacuum manifold, or any enclosed inert environment.
- If procedure is done in the fume hood, use the sash as a safety shield. For hoods with a horizontal sliding sash, position the sash all the way down, stand behind the sliding windows and reach around to perform the manipulations required. For hoods with vertical sliding sash, keep the sash as low as possible.
- Face shields are to be used when there is no protection from the hood sash or when the hood sash is open.
- Remove any flammables (spray bottles containing solvents, oil baths) and combustibles (Kimwipes, paper towels) from the work area.
- Laboratories and rooms where Pyrophorics are used must have general room ventilation that is negative pressure with respect to the corridors and external environment. The laboratory/room door must be kept closed at all times.

5. Personal Protective Equipment

At a minimum, the following PPE must be worn at all times:

Eye Protection

- A. ANSI Z87.1-compliant safety glasses with side shields, or chemical splash goggles.
 - Ordinary prescription glasses will NOT provide adequate protection unless they also meet ANSI standard and have compliant side shields.
- B. If the potential for explosion/splashing exists, and adequate coverage is not provided by the hood sash, a face shield must be worn.

Skin Protection

- A. Wear non-synthetic clothing under lab coat.
- B. Flame-resistant lab coat (Nomex IIIA, NFPA 2112) must be worn when working with pyrophorics.



- C. A combination of fire resistant (FR) liners, covered with a pair of chemical-resistant disposable gloves (e.g. nitrile gloves or those specified in the specific SDS), must be worn AT ALL TIMES. The following products are Approved FR Liners: Ansell Kevlar® Goldknit® Lightweight 70-200 and Hanz Extremity Wear Nomex® Utility Liners.
- D. Long pants, closed-toe/closed-heel shoes, covered legs, and ankles.

6. First Aid Procedures and Medical Emergencies

In the event of an injury, notify your supervisor immediately and EH&S within 8 hours.



Go to the Occupational Health Facility (Tang Health Center, on campus); if after hours, go to the nearest emergency room (Alta Bates, 2450 Ashby Ave in Berkeley); or



Call 911 (from a cell phone: 510-642-3333) if:

- *it is a life threatening emergency; or*
- *you not are confident in your ability to fully assess the conditions of the environment and/or the condition of the contaminated/injured person, or you cannot be assured of your own safety; or*
- *the contaminated/injured person is not breathing or is unconscious.*

Please remember to provide a copy of the appropriate manufacturer SDS (if available) to the emergency responders or physician. At a minimum, be ready to provide the identity/name of any hazardous materials involved.

In case of skin contact

If skin contact occurs, and/or skin or clothing are on fire, immediately drench in the safety shower with copious amounts of water for no less than 15 minutes to remove any remaining contaminants. If possible to do so without further injury, remove any remaining jewelry or clothing.

In case of eye contact

Rinse thoroughly with plenty of water using an eyewash station for at least 15 minutes, occasionally lifting the upper and lower eyelids. Remove contact lenses if possible.

If swallowed

Do NOT induce vomiting unless directed otherwise by the SDS. Never give anything by mouth to an unconscious person. Rinse mouth with water.

Needle stick/puncture exposure

Wash the affected area with antiseptic soap and warm water for 15 minutes.

If inhaled

Move into fresh air.

7. Special Handling, Storage, and Disposal Requirements

Pyrophoric reagents can be handled and stored safely as long as all exposure to atmospheric oxygen and moisture or other incompatible chemicals is avoided. Never leave a container with a residue of a pyrophoric material open to the atmosphere.

Lab-specific information on handling and storage may be included in Section 12 - Protocol/Procedure section.

Handling and Storage of Pyrophoric Materials



- Process is to be performed under an inert atmosphere gas (use argon gas in the case of lithium metal).
- Liquids may be safely transferred without the use of a glove box by employing techniques discussed in your laboratory “PYR” Class SOP (syringe and cannula techniques).

Disposal of Pyrophoric Reagents

- Never leave a container with a residue of a pyrophoric material open to the atmosphere.
- Any unused or unwanted pyrophoric materials must be destroyed by following the specific destruction procedure(s) included in your “Hazardous Operation SOP – Quenching of Pyrophoric Materials”. As an alternative to quenching, remember that pyrophoric chemicals can be disposed of as hazardous waste (contact EH&S for guidance on disposal).
- Rinse the empty container three times with an inert dry COMPATIBLE solvent. The rinse solvent must be transferred in and out of the container under an inert atmosphere using the syringe or cannula technique.
- Solvent rinses must be disposed of as hazardous waste.

8. Chemical Spill and Fire Response

Pyrophoric Spill Response

- In the case of a spill, announce the situation loudly in the immediate area and have any nearby persons move to a safe location.
- Immediately eliminate/remove all nearby ignition sources.
- If spill occurs in a fume hood, cover with Met-L-X, dry sand, or other non-combustible material, close the hood sash and if present, press the red purge button.
- If a spill occurs outside a fume hood, cover with Met-L-X, dry sand, or other non-combustible material, and stand away from the spill.
- Locate and have a proper fire extinguisher (dry chemical-based) ready in case of ignition/fire.
- Use clean, non-sparking tools to collect absorbed material and place into loosely-covered metal or plastic containers ready for disposal.
- Do not use combustible materials (paper or cloth towels) to clean up a spill, as these may increase the risk of igniting the reactive compound.
- If you cannot assess the situation well enough to be sure of your own safety, do not approach the spill.
- Keep others from entering contaminated area (e.g., use caution tape, barriers, etc.).
- Report the spill to 510-642-3073.

Pyrophoric Fire Response

- Call **911** (from a cell phone: **510-642-3333**) for emergency assistance and for assistance with all fires, even if extinguished.
- If the spill ignites, and if you are trained and you feel comfortable to do so, extinguish the fire with an appropriate fire extinguisher. Use only dry chemical fire extinguishers (classes ABC or D). Do not use a CO₂ extinguisher.
- A can of Met-L-X or dry sand in the work area, within arm’s reach, might be helpful to extinguish any small fire as it can smother the flames.
- Do not use water to extinguish a pyrophoric chemical fire as it may enhance the intensity of the fire. An exception to this would be in the case of skin contact or ignited clothing/skin. In these cases, rinsing any unreacted chemical off is of primary importance.



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Be AWARE: Small flames at the tip of the needles can be produced – expect this to occur, and do not panic. The can of Met-L-X/sand is in the hood to quickly extinguish those small flames. Carbon Dioxide, Foam, Halon, and Fire blanket are UNSUITABLE for extinguishing metal alkyl fires.

9. Cleaning and Decontamination

Lab-specific information on decontamination may be included in Section 12 - Protocol/Procedure.

- Wearing proper PPE, laboratory work surfaces must be cleaned at the conclusion of each procedure and at the end of each work day.
- Decontaminate all equipment before removing from a designated area.

10. Hazardous Waste Disposal

Label Waste

- Label all waste containers. See the EH&S Fact Sheet, “Hazardous Waste Management” for general instructions on procedures for disposing of hazardous waste.

Dispose of Waste

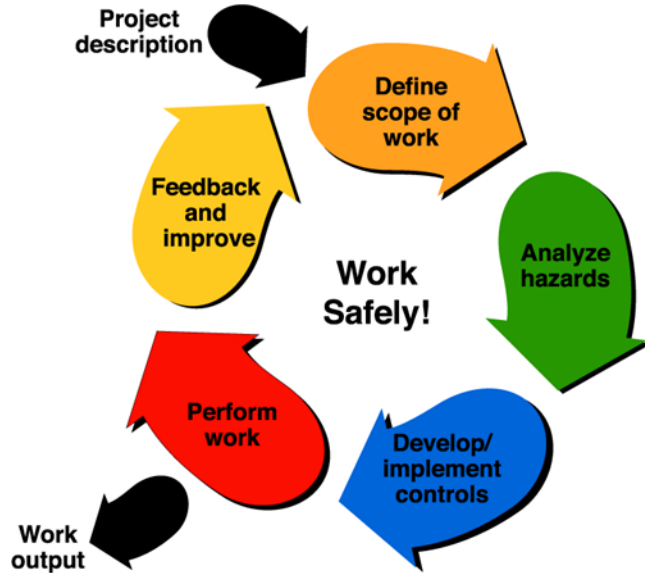
- Dispose of regularly generated chemical waste within 6 months.
- Call EH&S with questions.

11. Safety Data Sheet (SDS) Location

SDS can be accessed online at <http://ucsd.com>



-Take Ownership of Your Safety-



Before starting any work, ask yourself:

- 1- **What will I be doing?**
- 2- **Do I know what the hazards are?**
- 3- **Do I have everything I need to do the job safely?**
- 4- **Am I doing the job safely?**
- 5- **What can we do better?**



12. Protocol/Procedure - Quenching of Pyrophoric Materials

Section 12 must be customized to your specific needs. Delete any procedure that does not apply to your laboratory.

Procedure/Use	Scale	Engineering Controls/Equipment	PPE (eye, face, gloves, clothing)	Procedure Steps and Special Precautions for this Procedure
<p>1. Quenching of t-ButylLithium (t-BuLi) remaining in bottle or left after reactions.</p>	<p>Up to 100 mL of t-BuLi solution in carrier solvent. Quenching of t-BuLi in amounts greater than 100 ml at a time is not permitted.</p> <p><i>See note for appropriate glassware size selection.</i></p> <p>Minimal quantities will be left after reactions carried out at scales listed in your laboratory "PYR" Class SOP.</p> <p>As an</p>	<p>Conduct in a clean fume hood with the sash as low as possible using the Schlenck techniques, or an inert atmosphere glove box.</p>	<p>Eye Protection: Wear fitted safety goggles or safety glasses with side shields.</p> <p>Face Protection: Face shields are to be used when there is no protection from the hood sash.</p> <p>Hand Protection: Confirm compatibility of glove material with chemical being used. Gloves must be inspected prior to use. Wash and dry hands after use.</p> <p>General guidance : For indirect contact (closed-system procedures such as transfers via syringe or cannula) AND direct contact (open system procedures such as spill handling, wiping of residual pyrophorics) with pyrophoric material - a combination of fire resistant (FR) liners, covered with a pair of chemical-resistant disposable gloves (e.g. nitrile gloves or those specified in the specific SDS)), must be worn AT ALL TIMES. The following products are Approved FR Liners: Ansell Kevlar® Goldknit® Lightweight 70-200 and Hanz</p>	<p><i>Note on Glassware Size:</i> If quenching 20mL of pyrophoric solution, the pyrophoric material will be diluted in 400mL of inert solvent to start the quenching procedure (5% wt solution). In this case, the required size for the quenching vessel is 1L, no less.</p> <p>- Quenching in a FUME HOOD using a Schlenk line -</p> <p><u>General considerations:</u></p> <p>Quenching procedures usually involve the reaction of the pyrophoric material, under inert atmosphere and on an ice bath, with a reagent that has a reactive hydroxyl group.</p> <p>Any reaction or suspension containing these reagents MUST be quenched carefully! All transfers must be done under inert atmosphere using the syringe or cannula techniques.</p> <p>Addition of material must be done SLOWLY, under adequate stirring/mixing.</p> <p>Whenever quenching, be sure that it is <u>not</u> done in a sealed vessel as pressure will build up. The best situation is to have an inert gas flowing in with a small exit needle connected to a bubbler.</p> <p>If you're quenching in a RB flask or any floating vessel in a bath, clamp it. If the solution level is low, you can dilute it with some inert solvent such as toluene or hexane first to less than 5% wt.</p> <p><u>Procedure:</u></p> <p>Transfer the t-BuLi solution to the quenching vessel, bring the temperature of the quench solution to -78°C</p>



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	<p>alternative to quenching, remember that any quantities of t-BuLi can be disposed of as hazardous waste.</p> <p>Obtain PI approval if higher scale is necessary.</p>		<p>Nomex® Flame Resistant Utility Liner Gloves.</p> <p>Clothing: Wear Nomex IIIA (NFPA 2112) lab coat; wear non-synthetic clothing under lab coat; full length pants or equivalent; and close-toed and close-heeled shoes.</p>	<p>using a dry ice/isopropanol bath, turn on the stirrer. Before proceeding with the quenching of the pyrophoric solution, immediately proceed with the cleaning of the empty bottle.</p> <p>Rinse the empty container three times with an inert dry COMPATIBLE solvent such as toluene or hexane. The rinse solvent must be transferred in and out of the container under an inert atmosphere using the syringe or the cannula technique.</p> <p>After the empty container is triple-rinsed, remove the sure-seal cap and leave it open in the back of the fume hood overnight.</p> <p>Dispose of the solvent rinse as hazardous waste.</p> <p>Proceed with the quenching of the pyrophoric solution by adding isopropanol slowly to the quenching vessel using a syringe or an addition funnel, under adequate stirring, until no more bubbling is observed.</p> <p>Keep the solution cool during the quenching process by controlling the feed rate of the alcohol.</p> <p>Once you've added the isopropanol, add the following solvents in sequence, using the same step-wise caution: ethanol, methanol, and water.</p> <p>Be Very Careful with the addition of water! Even after methanol has been added, the lithiate can still react violently with water, especially if there hasn't been sufficient mechanical stirring of the solution. Add water in small aliquots. The addition of water does not need to be conducted under an inert atmosphere. Syringes (plastic or glass) are ideal tools to make these additions.</p> <p>Once the addition of water is complete, let the solution temperature come back to room temperature while stirring.</p> <p>Stir for an additional 2 hours before disposing of the aqueous organic waste.</p>
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				<p>- Quenching in a GLOVE BOX -</p> <p><u>General considerations:</u></p> <p>Any reaction or suspension containing these reagents MUST be quenched carefully! Addition of solvents must be done SLOWLY with adequate stirring/mixing.</p> <p>If the glove box is equipped with a fridge, DO NOT open the fridge during the quenching process.</p> <p><u>Procedure:</u></p> <p>Turn OFF the glove box circulation.</p> <p>Remove bottle sure-seal cap or reaction vessel cap and add a stirrer if necessary.</p> <p>Typically, a solution of less than 5%wt of pyrophoric in an inert solvent (such as dry and degassed hexane or heptane) is created, followed by the slow addition of dry and degassed isopropanol, under adequate stirring until no more bubbling is observed.</p> <p>Place a cap on the quenching vessel and put the bottle/vessel in a zip-top bag before taking it out of the glove box.</p> <p>Move the quenching vessel to a clean fume hood. Always place the quenching vessel in a secondary container for transfer to the fume hood.</p> <p>Purge the glove box for 20-30 minutes.</p> <p>Under adequate stirring, add water SLOWLY to the quenching solution until no more bubbling is observed. This step does not need to be conducted under an inert atmosphere. Syringes (plastic or glass) are ideal tools to make these additions.</p> <p>Be Very Careful with the addition of WATER! Even after isopropanol has been added, the lithiate can still react violently with water, especially if there hasn't been sufficient mechanical stirring of the solution. Therefore the water must be added in small aliquots.</p>
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				<p>Stir for an additional 2 hours before disposing of the aqueous organic waste.</p> <p>Rinse the empty container three times with an inert dry COMPATIBLE solvent such as toluene or hexane.</p> <p>After the empty container is triple-rinsed, leave it open in the back of the hood overnight.</p> <p>Solvent rinses must be disposed of as hazardous waste.</p>
Notes	Any deviation from this SOP requires approval from PI.			



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Procedure/Use	Scale	Engineering Controls/Equipment	PPE (eye, face, gloves, clothing)	Procedure Steps and Special Precautions for this Procedure
<p>2. Quenching of pyrophoric liquids, such as, but not limited to, sec-BuLi, n-BuLi, Grignard reagents, remaining in bottle or left after reactions.]</p>	<p>Up to 500 mL of pyrophoric materials in carrier solvent. Quenching of pyrophoric materials in amounts greater than 500 mL at a time is not permitted.</p> <p><i>See note for appropriate glassware size selection.</i></p> <p>Minimal quantities will be left after reactions carried out at scales listed in your laboratory "PYR" Class SOP.</p> <p>**As an alternative to quenching, remember that any quantities of t-</p>	<p>Conduct in a clean fume hood with the sash as low as possible using the Schlenk techniques, or an inert atmosphere glove box.</p>	<p>Eye Protection: Wear fitted safety goggles or safety glasses with side shields.</p> <p>Face Protection: Face shields are to be used when there is no protection from the hood sash.</p> <p>Hand Protection: Confirm compatibility of glove material with chemical being used. Gloves must be inspected prior to use. Wash and dry hands after use.</p> <p>General guidance: For indirect contact (closed-system procedures such as transfers via syringe or cannula) AND direct contact (open system procedures such as spill handling, wiping of residual pyrophorics) with pyrophoric material - a combination of fire resistant (FR) liners, covered with a pair of chemical-resistant disposable gloves (e.g. nitrile gloves or those specified in the specific SDS)), must be worn AT ALL TIMES. The following products are Approved FR Liners: Ansell Kevlar® Goldknit® Lightweight 70-200 and Hanz Nomex® Flame Resistant Utility Liner Gloves.</p>	<p>Note on Glassware Size: If quenching 100mL of pyrophoric solution, the pyrophoric material will be diluted in 500mL of inert solvent to start the quenching procedure (20% wt solution). In this case, the required size for the quenching vessel is 1L, no less. If quenching 500 mL of pyrophoric material, the required size for the quenching vessel is 2L, no less.</p> <p>- Quenching in a FUME HOOD using a Schlenk line -</p> <p><u>General considerations:</u></p> <p>Quenching procedures usually involve the reaction of the pyrophoric material, under inert atmosphere and on an ice bath, with a reagent that has a reactive hydroxyl group.</p> <p>Any reaction or suspension containing these reagents MUST be quenched carefully! All transfers must be done under inert atmosphere using the syringe or cannula techniques.</p> <p>Addition of material must be done SLOWLY, under adequate stirring/mixing.</p> <p>Whenever quenching, be sure that it is <u>not</u> done in a sealed vessel as pressure will build up. The best situation is to have an inert gas flowing in with a small exit needle connected to a bubbler.</p> <p>If you're quenching in a RB flask or any floating vessel in a bath, clamp it. If the solution level is low, you can dilute it with some inert solvent such as toluene or hexane first to less than 20% wt.</p> <p><u>Procedure:</u></p> <p>Transfer the diluted solution to the quenching vessel, place an ice under the flask, and turn on the stirrer.</p>



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	<p>BuLi can be disposed of as hazardous waste. Be sure to label appropriately and to submit waste for pickup immediately.*</p> <p>* Obtain PI approval if higher scale is necessary.</p>		<p>Clothing: Wear Nomex IIIA (NFPA 2112) lab coat; wear non-synthetic clothing under lab coat; full length pants or equivalent; and close-toed and close-heeled shoes.</p>	<p>Before proceeding with the quenching of the pyrophoric solution, proceed with the cleaning of the empty bottle.</p> <p>Rinse the empty container three times with an inert dry COMPATIBLE solvent such as toluene or hexane. The rinse solvent must be transferred in and out of the container under an inert atmosphere.</p> <p>After the empty container is triple-rinsed, remove the sure-seal cap and leave it open in the back of a hood overnight.</p> <p>Dispose of the solvent rinse as hazardous waste.</p> <p>Proceed with the quenching of the pyrophoric solution by adding isopropanol slowly to the quenching vessel using a syringe or an addition funnel, under adequate stirring, until no more bubbling is observed.</p> <p>Keep the solution cool (50°C or below) during the quenching process by controlling the feed rate of the alcohol.</p> <p>Once you've added the isopropanol, add the following solvents in sequence, using the same step-wise caution: ethanol, methanol, and water.</p> <p>Be Very Careful with the addition of water! Even after methanol has been added, the lithiate can still react violently with water, especially if there hasn't been sufficient mechanical stirring of the solution. Add water in small aliquots. The addition of water does not need to be conducted under an inert atmosphere. Syringes (plastic or glass) are ideal tools to make these additions.</p> <p>Once the addition of water is complete, let the solution temperature come back to room temperature while stirring.</p> <p>Stir for an additional 2 hours before disposing of the aqueous organic waste.</p>
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				<p>- If quenching in a FUME HOOD using dry ice - <i>Place dry ice in a container and add a stir bar. Pyrophoric liquids in this section can be quenched by slowly adding the dilute solution directly onto dry ice, then adding a mildly reactive quenching agent such as methanol.</i> Once the addition of the dilute solution is complete, let the solution temperature come back to room temperature under stirring. Stir for an additional 2 hours before disposing of the aqueous organic waste.</p> <p>- If quenching in a GLOVE BOX - <u>General considerations:</u> Any reaction or suspension containing these reagents MUST be quenched carefully! Addition of solvents must be done SLOWLY with adequate stirring/mixing. If the glove box is equipped with a fridge, DO NOT open the fridge during the quenching process.</p> <p><u>Procedure:</u> Turn OFF the glove box circulation. Remove bottle or reaction vessel cap and add a stirrer if necessary. Typically, a solution of less than 20%wt of pyrophoric in an inert solvent (such as dry and degassed hexane or heptane) is created, followed by the slow addition of dry and degassed isopropanol, under adequate stirring until no more bubbling is observed. Place a cap on the quenching vessel and put the bottle/vessel in a zip-top bag before taking it out of the glove box. Move the quenching vessel to a clean fume hood. Always place the quenching vessel in a secondary container for transfer to the fume hood.</p>
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				<p>Purge the glove box for 20-30 minutes.</p> <p>Continue the quenching procedure in a clean fume hood with sash closed.</p> <p>Under adequate stirring, add water SLOWLY to the quenching solution until no more bubbling is observed. This step does not need to be conducted under an inert atmosphere. Syringes (plastic or glass) are ideal tools to make these additions.</p> <p>Be Very Careful with the addition of WATER! Even after isopropanol has been added, the lithiate can still react violently with water, especially if there hasn't been sufficient mechanical stirring of the solution. Therefore the water must be added in small aliquots.</p> <p>Once the addition of water is complete, stir for an additional 2 hours before disposing of the aqueous organic waste.</p> <p>Rinse the empty container three times with an inert dry COMPATIBLE solvent such as toluene or hexane.</p> <p>After the empty container is triple-rinsed, leave it open in the back of the hood overnight.</p> <p>Solvent rinses must be disposed of as hazardous waste.</p>
Notes	Any deviation from this SOP requires approval from PI.			



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Procedure/Use	Scale	Engineering Controls/Equipment	PPE (eye, face, gloves, clothing)	Procedure Steps and Special Precautions for this Procedure
3. Quenching of pyrophoric solids.]	<p>Up to 10g of material.</p> <p><i>See note for appropriate glassware size</i></p> <p>Minimal quantities will be left after reactions carried out at scales listed in your laboratory "PYRClass SOP.</p> <p>As an alternative to quenching, remember that any quantities of t-BuLi can be disposed of as hazardous waste.</p>	<p>Conduct in a clean fume hood with the sash as low as possible using the Schlenk techniques, or an inert atmosphere glove box.</p>	<p>Eye Protection: Wear fitted safety goggles or safety glasses with side shields.</p> <p>Face Protection: Face shields are to be used when there is no protection from the hood sash.</p> <p>Hand Protection: Confirm compatibility of glove material with chemical being used. Gloves must be inspected prior to use. Wash and dry hands after use.</p> <p>General guidance: For indirect contact (closed-system procedures such as transfers via syringe or cannula) AND direct contact (open system procedures such as spill handling, wiping of residual pyrophorics) with pyrophoric material - a combination of fire resistant (FR) liners, covered with a pair of chemical-resistant disposable gloves (e.g. nitrile gloves or those specified in the specific SDS)), must be worn AT ALL TIMES. The following products are Approved FR Liners: Ansell Kevlar® Goldknit®</p>	<p>Note on Glassware Size: If quenching 100mL of pyrophoric solution, the pyrophoric material will be diluted in 500mL of inert solvent to start the quenching procedure (20% wt solution). In this case, the required size for the quenching vessel is 1L, no less.</p> <p>- If quenching in a FUME HOOD using a Schlenk line -</p> <p><u>General considerations:</u></p> <p>Quenching procedures usually involve the reaction of the pyrophoric material, under inert atmosphere and on an ice bath, with a reagent that has a reactive hydroxyl group.</p> <p>Any reaction or suspension containing these reagents MUST be quenched carefully! All transfers must be done under inert atmosphere using the syringe or cannula techniques.</p> <p>Addition of material must be done SLOWLY and ensure adequate stirring/mixing.</p> <p>Whenever quenching, be sure that it is not done in a sealed vessel as pressure will build up. The best situation is to have an inert gas flowing in with a small exit needle connected to a bubbler.</p> <p>If you're quenching in a RB flask or any floating a vessel in a bath, clamp it.</p> <p><u>Procedure:</u></p> <p>Typically, a suspension of less than 20%wt of pyrophoric in an inert solvent (such as hexane or toluene) is created, followed by the slow addition of isopropanol using a syringe or an addition funnel, under</p>



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			<p>Lightweight 70-200 and Hanz Nomex® Flame Resistant Utility Liner Gloves.</p> <p>Clothing: Wear Nomex IIIA (NFPA 2112) lab coat; wear non-synthetic clothing under lab coat; full length pants or equivalent; and close-toed and close-heeled shoes.</p>	<p>adequate stirring until no more bubbling is observed. During the quenching process, keep the solution cool, 50°C or below, by application of an external cooling bath (ice bath) and by controlling the feed rate of the alcohol.</p> <p>Once you've added the isopropanol, add the following solvents in sequence, using the same step-wise caution: ethanol, methanol, and water.</p> <p>Be Very Careful with the addition of water! Even after methanol has been added, the lithiate can still react violently with water, especially if there hasn't been sufficient mechanical stirring of the solution. Add water in small aliquots. The addition of water does not need to be conducted under an inert atmosphere. Syringes (plastic or glass) are ideal tools to make these additions.</p> <p>Once the addition of water is complete, let the solution temperature come back to room temperature while stirring.</p> <p>Stir for an additional 2 hours before disposing of the aqueous organic waste.</p> <p>Rinse the empty container three times with an inert dry COMPATIBLE solvent.</p> <p>After the empty container is triple-rinsed, leave it open in the back of the hood overnight.</p> <p>Solvent rinses must be disposed of as hazardous waste.</p> <p>- If quenching in a GLOVE BOX -</p> <p><u>General considerations:</u></p> <p>Any reaction or suspension containing these reagents MUST be quenched carefully! Addition of solvents must be done SLOWLY with adequate stirring/mixing.</p> <p>If the glove box is equipped with a fridge, DO NOT open the fridge during the quenching process.</p>
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				<p><u>Procedure:</u></p> <p>Turn OFF the glove box circulation.</p> <p>Remove bottle or reaction vessel cap and add a stirrer if necessary.</p> <p>Typically, a suspension of less than 20%wt of pyrophoric in an inert solvent (such as dry and degassed hexane or heptane) is created, followed by the slow addition of dry and degassed isopropanol, under adequate stirring until no more bubbling is observed.</p> <p>Place a cap on the quenching vessel and put the bottle/vessel in a Ziploc bag before taking it out of the glove box.</p> <p>Move the quenching vessel to a clean fume hood. Always place the quenching vessel in a secondary container for transfer to the fume hood.</p> <p>Purge the glove box for 20-30 minutes.</p> <p>Under adequate stirring, add water SLOWLY to the quenching solution until no more bubbling is observed. This step does not need to be conducted under an inert atmosphere. Syringes (plastic or glass) are ideal tools to make these additions.</p> <p>Be Very Careful with the addition of WATER! Even after isopropanol has been added, the lithiate can still react violently with water, especially if there hasn't been sufficient mechanical stirring of the solution. Therefore the water must be added in small aliquots.</p> <p>Once the addition of water is complete, stir for an additional 2 hours before disposing of the aqueous organic waste.</p> <p>Rinse the empty container three times with an inert dry COMPATIBLE solvent.</p> <p>After the empty container is triple-rinsed, leave it open</p>
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Quenching of Pyrophoric Materials

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				in the back of the hood overnight. Solvent rinses must be disposed of as hazardous waste.
Notes	Any deviation from this SOP requires approval from PI.			

