



## UCSC Laboratory Standard Operating Procedure (SOP) Lithium Foil

<b>Department:</b>	Chemistry and Biochemistry	<b>Date:</b>	10/12/2013
<b>Principal Investigator/Supervisor:</b>	Yat Li	<b>Office Phone#:</b>	831-502-7363
<b>Procedure Author:</b>	Tianyu Liu	<b>Lab Phone#:</b>	831-502-7363
<b>Location(s) covered by this SOP/Building/Room#:</b>	PSB 198	<b>Author Email:</b>	tliu23@ucsc.edu



Review any applicable manufacturer/vendor safety information, such as a Safety Data Sheet (SDS), before developing the Standard Operating Procedure (SOP).




*Any deviation from this SOP requires approval from the PI.*

**#1 Brief Experimental Summary:** Provide a general description of the process and/or experimental procedure.

Lithium Foil will be used as the cathode material of a lithium-ion battery.

List the chemicals that fall under this SOP, include CAS#, and GHS symbols and categories:

Chemical (CAS#)	GHS categories	GHS symbols – choose the appropriate symbols for each chemical
Lithium (Li) (CAS# 7439-93-2)	Corrosives, Water Reactive	Substances, which in contact with water, emit flammable gases (Category 1); Skin corrosion (Category 1B); Serious eye damage (Category 1) 
Carbonates: Flammable liquid, Irritant CAS# Varies <b>NOTE:</b> For each carbonate consult the SDS for hazard information, obtain approval from the PI, and modify this SOP as required prior to use.		
Ethylene Carbonate (CAS# 96-49-1)	Irritant	Acute toxicity, Dermal (Category 5); Skin irritation (Category 2); Eye irritation (Category 2A); Specific target organ toxicity - single exposure (Category 3) 
Diethyl Carbonate (CAS# 105-58-8)	Flammable liquid, Irritant	Flammable liquids (Category 3); Skin irritation (Category 2); Eye irritation (Category 2A); Specific target organ toxicity - single exposure (Category 3)

		 
Propylene Carbonate (CAS# 108-32-7)	Irritant	Skin irritation (Category 2); Eye irritation (Category 2A)  

**#2 Procedure Description:** Include all steps for the procedure from the preparation to waste disposal, along with decontamination/clean-up steps. For each step's description, include any step-specific hazard, personal protective equipment, engineering controls, designated work areas, and specific working alone restrictions in the left hand columns. Note the location and use of any emergency response equipment specific to process (e.g., Calgonate gel, Class D fire extinguisher, inert absorbent material).

**Working Alone:** Working alone is not recommended. Notify your coworkers prior to conducting this work and ensure that at a minimum of 1 person is nearby and aware that the work is occurring.

**Scale:** Work on as small a scale as possible. Do not exceed 0.5g (2cm<sup>2</sup>), without prior consultation with and approval by the PI.

Procedure Steps	Work Location / Safety Equipment	Precautions
1. Cut one piece lithium foil with an area of ~2cm <sup>2</sup> ; 2. Dip the lithium foil in 2 mL organic electrolyte (ethylene carbonate, diethyl carbonate, propylene carbonate, etc. in 10 mL beaker) for 3min. 3. Assemble the dipped lithium foil (No need to dry) into a battery coin cell and put on the platform of a presser inside the glove box. 4. Carefully screw down the top shaft to press the battery coin tightly in case to prevent electrolyte leaking. Press for 5 min (~20 MPa). Do not put the finger under the top shaft. 5. After pressing, screw up the top shaft and take the battery coin out. The as-prepared battery coin can be used to test performance.	<b>Work in glove box only;</b> <b>Eyewash/safety shower</b> – In the lab, near the inside door; <b>Fire extinguisher</b> – Outside the lab and directly face to the entrance door; <b>Fire alarm pull station</b> – Outside the lab and directly face to the entrance door;	<b>Work in glove box only, never conduct procedures outside.</b>

**Chemical Equation Graphic (optional):**

NA

**#3 Personal Protective Equipment (PPE):** List the personal protective equipment used during this process.

**Note:** PPE is to be worn by those conducting the work and any adjacent personnel.

**Eye Protection:** ANSI-approved properly fitting safety glasses or goggles. Chemical splash goggles and/or full face shield during activities which pose a splash hazard.

**Body Protection:** An appropriately-sized lab coat must be worn and buttoned. Laboratory coat sleeves must be of sufficient length to prevent direct skin exposure while wearing gloves. Full length pants (or equivalent) and closed toe/heel shoe attire must be worn at all times by all workers who are occupying or entering a laboratory/technical area. The area of skin between the pants and shoe should not be exposed.

Check box for specialty lab coat:  Nomex/Flame Resistant     Biological Barrier     Other [Click here to enter text.](#)

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PI: Li

Version: DRAFTv5

**Hand Protection:** Wear chemical-resistant gloves; remove gloves and wash hands with soap and water after use. Double gloves may provide additional protection for some chemicals. If prolonged contact or immersion is anticipated, consult with EH&S to identify appropriate protective gloves.

**Additional Protection:**  Face Shield       Chemical-Proof Apron       Respiratory Protection  
 Additional Gloves Click here to enter text.       Other Click here to enter text.

**#4 Incompatible Conditions and Materials:** *List the incompatible conditions, chemicals, and/or materials that should be avoided, along with the safe storage conditions.*

Avoid water and moisture. Always handle lithium foil inside the glove box.

Material:	Incompatibility:	Storage Conditions:
Li	Forms shock-sensitive mixtures with certain other materials., Iron and iron salts., Heavy metals, Phosphorus, Sulphur compounds, Oxygen, Nickel, Do not store near acids., Metals	Store under inert atmosphere and keep container tightly closed in a dry, well-ventilated space.
Ethylene Carbonate	Strong oxidizing agents, acids, Bases, Reducing agents	Keep container tightly closed in a dry and well-ventilated place.
Diethyl Carbonate	Strong acids, Oxidizing agents, Strong bases, Reducing agents	Store under inert gas. Moisture sensitive.
Propylene Carbonate	Strong oxidizing agents	Keep container tightly closed in a dry and well-ventilated place.

**#5 Training:** *Training required for all personnel conducting this procedure. Include any specific training requirements.*

- Complete EH&S online “Laboratory Safety Fundamentals” class available through the UC Learning Center (<http://learningcenter.ucsc.edu/>).
- Review and sign Lab-Specific Training Checklist (<http://ehs.ucsc.edu/lab-safety-manual/training.html#lab-specific%20training>) with PI, Lab Safety Representative, or other designated person.
- Review SOP with knowledgeable person.
- Complete training on specialized equipment prior to use (e.g., ultracentrifuge, hydrogenation apparatus).
- Other EH&S training requirements (e.g., Biosafety, Radiation Safety, Hazardous Waste Management).
- Click here to enter text.

**#6 Clean-Up, Spill, and Emergency Response Procedures** (reference the SDS as needed): *Provide any specific information.*

**Decontamination/Clean-Up:** Wash bench and/or work area with soap and water after using. When handling samples in the glove box, make sure cover the rubber gloves with a pair of nitrile gloves to avoid contamination on rubber gloves.

**Specific Spill Clean-Up Procedures:** Ensure that a bucket of sand or some absorbent material is readily available and in the vicinity of the work location. Click here to enter text.

Do not attempt to clean up any spill or release for which you are not fully trained and equipped. For assistance with spill cleanup, dial **911** and ask dispatch to page EH&S.

- Isolate the area to prevent the spread of contamination (e.g. close doors to affected area, post warning signs, alert others in immediately vicinity to evacuate).
- Prevent spill from reaching drains or from spilling outside of the fume hood if possible to do so without exposing yourself to liquid or vapor.
- Clean the affected area and all exposed equipment with soap and water to remove any contaminants before resuming work.
- Spill clean-up materials should be disposed of as hazardous waste.



**Laboratory Emergency Response Equipment:** All research personnel must know location of nearest fire alarm pull station and emergency shower/eyewash. Do not use fire extinguisher unless you are trained to do so. List locations for nearest fire alarm pull and emergency shower/eyewash.

**Fire alarm pull station** – Outside the lab and directly face to the entrance door;

**Eyewash/safety shower** – In the lab, near the inside door

**Emergency Shutdown Procedures:** Turn off any heating apparatuses.

**#7 Hazardous Waste(s):** List expected concentrations and amounts of hazardous waste(s) generated during this process. Provide any special/specific waste management. Contact EH&S for specific guidance regarding hazardous waste handling and disposal. General hazardous waste management guidelines: <http://ehs.ucsc.edu/programs/waste-management/index.html>

The synthesized waste Li ion battery coin should be collected in a battery waste container with an appropriate hazardous waste tag. Excess amount of electrolyte should go to the waste electrolyte container in the glove box with lid sealed. Li foil scraps should put in a bottle with “Li foil waste” label and lid sealed in the glove box.

#### **Waste Labeling**

- Affix an on-line hazardous waste tag on all waste containers using the Online Tag Program (OTP) <http://otp.ucop.edu/> as soon as the first drop of waste is added to the container.

#### **Waste Storage**

- Store hazardous waste in closed containers, in clean secondary containment, segregated by hazard class, in a marked and designated waste accumulation area.
- Double-bag dry waste using transparent bags.
- Waste accumulation area must be under the control of the person generating the waste.

#### **Waste Disposal**

- Hazardous waste must be removed from the lab within 180 days.
- Containers must be clean, sealed, and safe to transport.
- Mark container as ready for pick up in OTP, move container to accumulation area.
- Contact EH&S at x9-3086 for questions.

**#8 First Aid / Emergency Procedures:** Describe immediate First Aid or medical treatment required in case of personnel exposure.

Click here to enter text.

For immediate medical assistance, dial **911**. Report all serious injuries to EH&S as soon as possible.

- If inhaled, move into fresh air immediately.
- In the case of eye or skin contact, flush with water for a minimum of 15 minutes. Ensure that eyelids are held open while rinsing eyes.
- If ingested, flush mouth with water (only if the person is conscious).
- In the case of a needlestick/puncture injury, wash the affected area with soap and warm water for 15 minutes. For employees, follow the instructions at the Risk Services website: <http://risk.ucsc.edu/workers-comp/reporting-and-treatment.html>
- Seek medical attention immediately.
- Complete incident report form, <http://risk.ucsc.edu/all-forms/wc-incident-report-form.pdf>, (contact EH&S) and/or follow the instructions at the Risk Services website: <http://risk.ucsc.edu/workers-comp/reporting-and-treatment.html>

As the Principal Investigator, it is your responsibility to ensure that all individuals conducting this protocol are taught the correct procedures for safe handling of the hazardous materials involved. It is also your responsibility to ensure that your personnel complete Laboratory Safety Training and other applicable safety training courses.

- Prior to conducting any work with Li foil, the PI or designee must provide training to his/her laboratory personnel regarding the specific hazards involved in working with this substance, work area decontamination, and emergency procedures.
- The Principal Investigator must provide his/her laboratory personnel with a copy of this SOP and a copy of the SDS provided by the manufacturer.
- The Principal Investigator must ensure that his/her laboratory personnel have attended appropriate laboratory safety training or refresher training within the last year.

***I have reviewed and approve this Standard Operating Procedure.***



UNIVERSITY OF CALIFORNIA  
**SANTA CRUZ**

A handwritten signature in black ink, appearing to be "H. Li".

10/21/2013

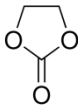
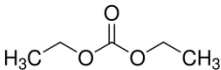
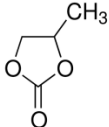
DATE

PI Signature

## Chemical Information Summary

*Provide information for all chemicals included in the SOP. See the SDS for detailed toxicity information. Add more lines as needed.*

### Physical & Chemical Properties

Chemical	CAS#	Molecular Formula	Structure	Molecular Weight (g/mol)	Density (g/mL)	Form (physical state)	Melting Point ( °C )	Boiling point ( °C )	Flash point ( °C )
Li	7439-93-2	Li	Li	6.94	0.534	Solid	180 (356 °F) - lit.	1,342 (2,448 °F) - lit.	NA
Ethylene Carbonate	96-49-1	C <sub>3</sub> H <sub>4</sub> O <sub>3</sub>		88.06	1.321	Crystalline	35 - 38 (95 - 100 °F) - lit.	243 - 244 (469 - 471 °F) at 987 hPa (740 mmHg) - lit.	143 (289 °F) - closed cup
Diethyl Carbonate	105-58-8	C <sub>5</sub> H <sub>10</sub> O <sub>3</sub>		118.13	0.975	Liquid	-43 (- 45 °F) - lit.	126 - 128 (259 - 262 °F) - lit.	25 (77 °F) - closed cup
Propylene Carbonate	108-32-7	C <sub>4</sub> H <sub>6</sub> O <sub>3</sub>		102.09	1.189	Liquid	-55 (- 67 °F) - lit.	240 (464 °F) - lit.	132 (270 °F) - closed cup

### Exposure Limits/Toxicity Data



Chemical	Color	Odor	Cal/OSHA PEL	Toxicity LD <sub>50</sub>
Li	NA	NA	NA	NA
Ethylene Carbonate	Colorless	NA	NA	Oral - rat - 10,000 mg/kg
Diethyl Carbonate	Colorless	NA	NA	NA
Propylene Carbonate	Colorless	NA	NA	Oral - mouse - 20,700 mg/kg







Version	Date	Revision Author	Summary of Changes
1	10/12/13	Tianyu Liu	Initial author
2	10/17/13	EH&S	Review, Added general categories for alcohols
3	10/17/2013	Tianyu Liu	Added procedural info
4	10/18/2013	EH&S	Added carbonates
5	10/21/2013	EH&S	EH&S Review
6	10/21/2013	Tianyu Liu	Added procedural and waste info