

# Standard Operating Procedure

This form is not complete until Approvals are logged.

## 1. General Information

### 1.1 Lab-Specific Information

Building/Room(s) covered by this SOP:	STEM 114
College/Organization:	COE
Department:	Mechanical Engineering Capstone, ERH2
Principal Investigator Name:	Dylan Astrup
SOP Effective Date (review annually at a minimum)	3/17/2023

### 1.2 - This Standard Operating Procedure (SOP) is for a:

<input type="checkbox"/> Specific laboratory procedure or experiment (e.g. synthesis of carbon nanotubes)
<input checked="" type="checkbox"/> Generic laboratory procedure that covers several chemicals (e.g. chromatography)
<input type="checkbox"/> Generic use of specific chemical/class of chemicals with similar hazards (e.g. organic azides)

### 1.3 - Hazard Summary

<input checked="" type="checkbox"/> Chemical hazard(s)	<input type="checkbox"/> Hazardous waste generated
<input type="checkbox"/> Physical hazard(s)	
<input type="checkbox"/> Biological hazard(s)	<input type="checkbox"/> Biological waste generated
<input type="checkbox"/> Radiological hazard(s)	<input type="checkbox"/> Radiological waste generated

### 1.4 - Approvals

Prior to conducting any work, the Principal Investigator must ensure that this SOP has been approved.

Inquire with EH&S as to which approvals are required.

Name	Signature	Date
Dylan Astrup		Click or tap to enter a date.
Michael Brady		Click or tap to enter a date.
Enter name of other approver, if applicable		Click or tap to enter a date.

## 2. Process or Experiment Description:

Note: You will need to complete Section 3 before you can draft your procedures section. This section appears first for usability of the final document, placing the most relevant information first.

### Materials & Equipment List:

- PPE (Safety goggles, nitrile gloves, lab coat)
- Beaker
- Glass stirring rod

### Chemical List:

- Graphitic Carbon Nitride
- Silicone
- Potassium Hydroxide

### Graphitic Carbon Nitride

#### Prerequisites:

1. Ensure PPE is available and in appropriate condition for use. Don PPE.

#### Procedure:

1. Place capsule and material under vent hood.
2. Remove one side of capsule.
3. Pour material into capsule.
4. Seal open side of capsule.
5. Enclose filled capsule in secondary sealed container.

### Silicone Gasket

#### Prerequisites:

1. Ensure PPE is available and in appropriate condition for use. Don PPE.

#### Procedure:

1. Place electrolyzer, pipe assembly, and silicone under vent hood.
2. Turn on vent hood.
3. Apply silicone gasket to all threaded connections.
4. Let dry for 10 minutes before removing from vent hood.

### Potassium Hydroxide

#### Prerequisites:

1. Ensure PPE is available and in appropriate condition for use. Don PPE.

#### Procedure:

1. Place beaker containing 1 liter of distilled water, electrolyzer, and potassium hydroxide under vent hood.

2. Pour 320 grams of potassium hydroxide into water.
3. Use glass rod to mix potassium hydroxide until fully dissolved.
4. Pour mixed water into electrolyzer.

### 3. Planning

#### 3.1 - Storage Requirements:

Select the type of storage cabinets required:

☐ Flammable   ☐ Corrosive   ☐ Toxic   ☐ Oxidizer   ☒ General

Store in cool, dry place. Handle with safety goggles and chemical-resistant gloves.

#### 3.2 - Engineering Controls:

☐ Process Control- Click here to enter text.

☐ Enclosure or Isolation- Click here to enter text.

☒ Redirection (e.g. ventilation) – Usage of all three chemicals will be done under a vent hood.

Note: Use of Engineering Controls should be evident in the detailed procedures in Section 2. If special steps are required for using the engineering control with this SOP, it needs to be addressed in your procedures. Otherwise, refer to the appropriate SOP for the engineering control in Section 2.

#### 3.3 - Personal Protective Equipment:

**Eyewear**   Safety Goggles

**Gloves**   ☒ Disposable Nitrile   ☐ Thermal/Cryogenic   ☐ Abrasion Resistant   ☐ Butyl Rubber/Neoprene  
☐ Other: Click here to enter text.

**Protective Clothing**   ☒ Lab Coat   ☐ Synthetic Lab Apron   ☐ Tyvek Suit   ☐ Shoe Covers  
☐ Formed Boots   ☐ Other: Click here to enter text.

**Respirator**   ☐ Air-purifying   ☐ Atmosphere-supplying   ☐ Filters/Cartridges: Click here to enter text.

Note: Refer to Section 8 of the SDS.

#### 3.4 - Spill and Accident Procedures

Safety Equipment (all located in STEM 114):

Showers

Eyewash station

Ventilation system

Graphitic Carbon Nitride

Sweep up, place in bag, hold for waste disposal.

Avoid raising dust, ventilate area, wash spill site after material pickup.

Silicone Gasket

Ensure adequate ventilation. Flood with water to complete polymerization. Scrape off floor, throw away.

Potassium Hydroxide

Sweep into corrosive resistant polypropylene container with a resistant inliner.

### 3.5 - Fire Safety

Safety Equipment (in STEM 114):

Fire extinguisher

Fire alarm manual pull station

Graphitic Carbon Nitride

N/A, non-combustible

Silicone

Flash point 93°C.

Will be kept below 50°C.

Potassium Hydroxide

Nonflammable.

Surrounding fire would cause thermal decomposition, releasing irritating gases.

Will not be near any heat source nor flame.

### 3.6 - Waste Disposal

Graphitic Carbon Nitride

No anticipated waste generation: Will be permanently kept in system.

Disposal if spilled: Graphitic Carbon Nitride dissolved in combustible solvent will be collected in an appropriate plastic or glass container, labeled flammable waste, and placed in the CAA for the building.

Silicone

No anticipated waste generation: Will become part of the system.

Disposal if spilled: Throw away.

Potassium Hydroxide

Waste produced at end of test campaign (this semester): about 1 liter of water with dissolved potassium hydroxide.

Disposal: Potassium Hydroxide will be collected in a plastic or glass container, labeled corrosive, and placed in the CAA for the building.

### 3.7 - Training Requirements

**Who must be trained on this SOP:** Team members (Dylan Astrup, Hannah Spiller, Tesla Alford, Titan Berson, Grant Carrabine, Jacob Wolf)

**Frequency of training for this SOP:** Initial only

**Documentation of Training** After training, each section of this SOP will be initialed by each team member to record understanding of the training & protocols. That document will be scanned and uploaded to our Microsoft Team with the rest of our team files. Complete EHS 101 Lab and Shop

Safety <https://erau.instructure.com/enroll/PGGAPA>

**Actions that trigger mandatory re-training:**

- |   |   |
|---|---|
| <input type="checkbox"/> Change in work conditions          | <input type="checkbox"/> Off-cycle update to SOP                          |
| <input checked="" type="checkbox"/> Non-compliance with SOP | <input type="checkbox"/> Other: <a href="#">Click here to enter text.</a> |

**Nature of training required for this SOP:**









- |   |  |  |
|---|--|--|
| <input type="checkbox"/> EHS-100 (online) | <input type="checkbox"/> In-person/classroom | <input checked="" type="checkbox"/> Hands-on |
|---|--|--|

**Additional training required for safe execution of this SOP:**

- |   |  |   |
|---|--|---|
| <input type="checkbox"/> Chemical Hygiene Plan                            | <input type="checkbox"/> Lab Safety Plan   | <input type="checkbox"/> Biological Safety Plan                           |
| <input type="checkbox"/> Radiation Safety Plan                            | <input type="checkbox"/> Engineering Controls: <a href="#">Click here to enter text.</a> |   |
| <input type="checkbox"/> Acid Dilutions                                   | <input type="checkbox"/> Chemical Container Labeling                                     | <input type="checkbox"/> Chemical Inventory                               |
| <input type="checkbox"/> Compressed Gas Cylinders                         | <input type="checkbox"/> Cryogenic Liquids   | <input checked="" type="checkbox"/> Eyewash & Safety Showers              |
| <input type="checkbox"/> Flammable Liquids                                | <input type="checkbox"/> General Reagents  | <input type="checkbox"/> Hazardous Waste                                  |
| <input type="checkbox"/> Heating Devices                                  | <input type="checkbox"/> Highly Reactive Chemicals                                       | <input type="checkbox"/> Housekeeping                                     |
| <input type="checkbox"/> Labware Washing                                  | <input type="checkbox"/> Nitric Acid   | <input type="checkbox"/> Non-hazardous Waste Disposal                     |
| <input type="checkbox"/> Phenolphthalein                                  | <input type="checkbox"/> PPE   | <input type="checkbox"/> Sharps Handling                                  |
| <input type="checkbox"/> Sodium Hydroxide Solutions                       | <input type="checkbox"/> Other: <a href="#">Click here to enter text.</a>                | <input type="checkbox"/> Other: <a href="#">Click here to enter text.</a> |
| <input type="checkbox"/> Other: <a href="#">Click here to enter text.</a> | <input type="checkbox"/> Other: <a href="#">Click here to enter text.</a>                | <input type="checkbox"/> Other: <a href="#">Click here to enter text.</a> |

## Appendix I. Detailed Hazards Description

Prepare this section as an attachment to the SOP. Use the following table to describe hazards. Refer to Safety Data Sheets (SDSs) and other resources like <https://toxnet.nlm.nih.gov/newtoxnet/hsdb.htm>. Copy/paste the table as many times as necessary based on the number of chemicals used in the procedure.

Click here to enter chemical name and CAS #	Choose an item.
<p><b>Physical Hazards</b></p> <div style="display: flex; flex-wrap: wrap;"> <div style="width: 50%;"> <input type="checkbox"/> Explosives  <input type="checkbox"/> Flammable Gases  <input type="checkbox"/> Flammable Aerosols  <input type="checkbox"/> Oxidizing Gases  <input type="checkbox"/> Gases under Pressure  <input type="checkbox"/> Flammable Liquids  <input type="checkbox"/> Oxidizing Liquids  <input type="checkbox"/> Oxidizing Solids  <input type="checkbox"/> Chemicals that emit flammable gases upon water contact                 </div> <div style="width: 50%;"> <input type="checkbox"/> Pyrophoric Liquids  <input type="checkbox"/> Pyrophoric Solids  <input type="checkbox"/> Pyrophoric Gases  <input type="checkbox"/> Self-Reactive  <input type="checkbox"/> Self-heating  <input type="checkbox"/> Corrosive to Metals  <input type="checkbox"/> Organic Peroxides  <input type="checkbox"/> Combustible Dusts                 </div> </div> <div style="display: flex; flex-wrap: wrap; margin-top: 10px;"> <div style="width: 33%; text-align: center;"> <input type="checkbox"/>  </div> <div style="width: 33%; text-align: center;"> <input type="checkbox"/>  </div> <div style="width: 33%; text-align: center;"> <input type="checkbox"/>  </div> <div style="width: 33%; text-align: center;"> <input type="checkbox"/>  </div> <div style="width: 33%; text-align: center;"> <input type="checkbox"/>  </div> <div style="width: 33%; text-align: center;"> <input type="checkbox"/>  </div> <div style="width: 33%; text-align: center;"> <input type="checkbox"/>  </div> <div style="width: 33%; text-align: center;"> <input type="checkbox"/>  </div> </div>	<p><b>Health Hazards</b></p> <input type="checkbox"/> Acute Choose an item. Toxicity Click here to enter Category # <input type="checkbox"/> Skin Corrosion/Irritation Click here to enter Category # <input type="checkbox"/> Serious Eye Damage/Irritation Click here to enter Category # <input type="checkbox"/> Respiratory or Skin Sensitization Click here to enter Category # <input type="checkbox"/> Germ Cell Mutagenicity Click here to enter Category # <input type="checkbox"/> Carcinogenicity Click here to enter Category # <input type="checkbox"/> Reproductive Toxicity Click here to enter Category # <input type="checkbox"/> Specific Choose an item. Target Organ Toxicity Click here to enter Category # <input type="checkbox"/> Aspiration Hazard Click here to enter Category # <input type="checkbox"/> Simple Asphyxiant Click here to enter Category # <p><b>Routes of Exposure</b></p> <input type="checkbox"/> Eye Contact <input type="checkbox"/> Inhalation <input type="checkbox"/> Ingestion <input type="checkbox"/> Skin Contact <input type="checkbox"/> Skin Absorption <p><b>Symptoms of Exposure</b></p> <p>Eye Contact: Click here to describe symptom(s) of exposure</p> <p>Skin Contact: Click here to describe symptom(s) of exposure</p> <p>Inhalation: Click here to describe symptom(s) of exposure</p> <p>Toxicity Limits: Click here to enter; Review Section 11 of SDS</p> <p>Exposure Monitoring: <input type="checkbox"/> No    <input type="checkbox"/> Yes State method(s).</p> <p><b>Other Hazards</b></p> <p>Click here to describe non-chemical hazards (e.g. biological, electrical, mechanical, nonionizing radiation, etc.)</p>

## Appendix II. Safety Data Sheets

Prepare this section by attaching the SDS for the chemicals used in this SOP. Use the specific SDS provided by the manufacturer of the chemical.