Standard Operating Procedure (SOP) for (_____*Ammonium metavanadate*_____)

PI Name: _____Yat Li_____ **Date: __10/12/2012_**

Name of Lab or Unit:___PSB 198_

Review any applicable manufacturer/vendor safety information before developing Standard Operating Procedure (SOP) and append UC Approved Chemical SOP, if available, or SDS and other Chemical reference materials if UC Chemical SOP is not available.

#1	Scope of Work/Activity: 1) Weigh ammonium metavandate (~0.3 g) on electronic balance (preferentially in fume hood or vented enclosure) using weigh paper, then transfer to beaker 2) Take to chemical fume hood, add deionized water (~50 mL) 3) Next stir solution using magnetic stirrer and stir bar to about 200 rpm until dissolved 4) Transfer to Teflon sleeve for reactor: place Teflon sleeve into steel reactor 5) Take solution and heat in oven to 180^{o}C for 12 hours 6) Remove excess water to waste. Use NH_4VO_3 as a precursor for vanadium oxide nanowires Ammonium metavanadate (CAS#7803-55-6) DANGER TOXIC
#2	Specific Safety and Environmental Hazards: **Potential Acute Health Effects:** Very hazardous in case of ingestion. Hazardous in case of skin contact (irritant), of eye contact (irritant), of inhalation (lung irritant). Slightly hazardous in case of skin contact (permeator). Severe over-exposure can result in death. **Potential Chronic Health Effects:** The substance may be toxic to blood, the nervous system, upper respiratory tract. Repeated or prolonged exposure to the substance can produce target organs damage. Repeated exposure to a highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.
#3	Describe in detail how the hazards will be controlled. a. Identify the **Engineering Controls** (e.g., fume hood, interlocks, shielding), work **Practices or Procedures**, or **Personal Protective Equipment** (e.g., gloves, respirator) that will be employed to reduce hazards to acceptable levels. After weighing the solid material on the lab bench, all operations involving ammonium metavanadate should be carried out in a chemical fume hood with the sash in the down position, between your chest and what you are handling in the hood. Wear lab coat, splash goggles, and disposable nitrile gloves. See PPE Section #5. b. Address **emergency shutdown** procedures.
#4	Designated Area: Indicate the area designated for performing this process in the laboratory. Weigh on electronic balance on lab bench, then conduct work in chemical fume hood.
#5	Personal Protective Equipment (PPE): 1. Chemical splash goggles. Face shield, optional. 2. Double nitrile gloves • Immediately replace with new gloves when contamination occurs. 3. Lab coat that covers limbs 4. Closed-toed, impervious footwear

#6	Important Steps to Follow: List the specific sequence of steps staff should follow to mitigate potentially hazardous conditions. 1. Take reagent from proper storage area and carefully transfer to working fume hood. 2. Transfer desired amount (1 g or less) to reaction vessel. A balance in a ventilated hood/weigh station should be used due to acute toxicity of chemical 3. Proceed with addition of chemical reagents using a funnel or syringe to minimize dust or aspiration inhalation hazard. 4. Work-up of reaction should be in the ventilated hood using gloves. 5. Intermediates and products should be in closed container at all times. 6. Dispose of waste products as in Section #9. **NOTE:** Consult with PI and obtain approval if greater than 1g of ammonium metavanadate are needed.
#7	Emergency / First Aid Procedures: **Eye or Skin Contact:** Check for and remove any contact lenses. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention immediately. **Inhalation:** If inhaled, remove to fresh air. Get medical attention immediately. **Ingestion:** Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention immediately.
#8	Training & Competency Requirements: Describe necessary training and demonstration of competency for performing the hazardous operation. 1. Prior to conducting any work with Ammonium metavanadate, designated personnel must provide training to his/her laboratory personnel specific to the hazards involved in working with this substance, work area decontamination, and emergency procedures. 2. The Principal Investigator must provide his/her laboratory personnel with a copy of this SOP and a copy of Ammonium metavanadate MSDS provided by the manufacturer. Read MSDS and SOP before use 3. The Principal Investigator must ensure that his/her laboratory personnel have attended the "Introduction to Laboratory Safety" class offered by EH&S within the last two years. 4. The Principal Investigator must ensure that his/her laboratory personnel complete the Lab-Specific Training Checklist prior to working in the lab.
#9	Identify hazardous waste(s) generated: Place waste in labeled solid waste container with hazardous waste tag complete. Waste solution containing ammonium metavanadate should be collected in liquid waste container with hazardous waste tag complete.
#10	Decontamination and spill clean-up procedures (reference embedded specific Chemical SOP as needed) Do not attempt to clean up any spill or release for which you are not fully trained and equipped. Contact 911 and ask for EH&S assistance for spill cleanup." For small spills, use appropriate tools to put the spilled solid in a convenient waste disposal container. Do not get water inside container. Do not touch spilled material.
#11	Laboratory Emergency Response Equipment: All research personnel must know location of nearest fire alarm pull station and emergency shower/eyewash. a. Note location and use of any emergency response equipment specific to process (e.g., Calgonate gel, Class D fire extinguisher)

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 assure that your personnel complete Laboratory Safety Training and other applicable safety training courses.

I have reviewed and approve this Standard Operating Procedure.

1/9/2013

PI Signature: DATE

Note that personnel associated with the protocol must sign the acknowledgement at the end of this document.

Chemical Hazards and Controls

Ammonium Metavanadate

This is a Chemical Hazard and Control template and is not complete until: 1) Chemical specific information is entered into the boxes below 2) It is appended to the protocol/procedural SOP and 3) Complete SOP has been signed and dated by the PI and relevant lab personnel.

Print a copy and insert into your
Laboratory Safety Manual and *Chemical Hygiene Plan with the Procedural SOP*.
Refer to instructions for assistance.

Department:	Chemistry
Date SOP was written:	December 12, 2012
Date SOP was approved by PI/lab supervisor:	
Principal Investigator:	Yat Li
Internal Lab Safety Coordinator/Lab Manager:	Tianyu Liu
Lab Phone:	
Office Phone:	831-459-1952
Emergency Contact:	Yat Li *(Name and Phone Number)*
Location(s) covered by this SOP:	**PSB 198** *(Building/Room Number)*

Purpose

Ammonium vanadate is an **irritant and acute toxin** and may be fatal if swallowed or inhaled. May affect the kidneys, respiratory system, skin and eyes. May aggravate pre-existing respiratory disorders. Ammonium vanadate belongs to the family of vanadates that contains many different oxidative states that are dependent on pH.

Physical & Chemical Properties/Definition of Chemical Group

CAS#: 7803-55-6

Class: **Irritant**

Molecular Formula: NH_4VO_3 (Ammonium metavanadate) Structure:

Molecular Weight: 116.98

Form (physical state): solid crystal

Density: 2.32 g/cm^3 at 25 °C (77 °F)

Color: White crystalline solid

Solubility: N/A

Boiling point: N/A

Melting point: N/A

Acute toxicity
Oral LD_{50}
LD_{50} Oral - rat - 58.1 mg/kg
Inhalation LC_{50}
LC_{50} Inhalation - rat - 4 h - 7.8 µg/l
Dermal LD_{50}
LD_{50} Dermal - rat - 2,102 mg/kg
Other information on acute toxicity
LD_{50} Intraperitoneal - rat - 18 mg/kg

LD_{50} Subcutaneous - rat - 23 mg/kg

Potential Hazards/Toxicity

Ammonium vanadate is **an irritant, and acute toxin** and harmful by ingestion. Vanadium compounds are considered to have variable toxicity, with some compounds producing a highly toxic fume, mist, or dust.

The permissible exposure limit for vanadium is 0.05 mg/m^3

Ammonium vanadate has the following toxicity data:
LD_{50}: 18 mg/kg (Rat)
LD_{50}: 23 mg/kg (Rat)

Inhalation

Very toxic if inhaled. Vanadium is an irritant to the respiratory tract. Both acute and chronic exposure to airborne vanadium compounds can give rise to conjunctivitis, nasal bleeding, rhinitis, irritation of the respiratory tract, and asthma-like diseases in more severe cases. May aggravate pre-existing respiratory disorders.

Eye Contact

Causes eye irritation.

Skin Contact

Causes skin irritation.

Ingestion

Toxic if swallowed. Do NOT induce vomiting unless directed by medical personnel. Never give anything by mouth to an unconscious person. Seek medical attention immediately.

Personal Protective Equipment (PPE)

Respiratory Protection

Respirators should be used only under any of the following circumstances:

- As a last line of defense (i.e., after engineering and administrative controls have been exhausted).
- When there is a possibility that a Cal/OSHA Permissible Exposure Limit (PEL) or Action Level (AL) will be exceeded.
- Regulations require the use of a respirator.
- An employer requires the use of a respirator.
- There is potential for harmful exposure due to an atmospheric contaminant (in the absence of a PEL).
- As protective equipment during a chemical spill clean-up process (only when approved by EH&S).

Lab personnel intending to use a respirator must be trained and fit-tested by EH&S. This is a regulatory requirement. (http://ehs.ucsc.edu/programs/safety-ih/respiratory-protection.html)

Hand Protection

Handle with gloves (ex. nitrile gloves). Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

NOTE: Consult with your preferred glove manufacturer to ensure that the gloves you plan on using are compatible with ammonium metavanadate.

Refer to glove selection charts from the links below:

http://www.ansellpro.com/download/Ansell_8thEditionChemicalResistanceGuide.pdf

OR

http://www.allsafetyproducts.biz/page/74172

OR

http://www.showabestglove.com/site/default.aspx

OR

http://www.mapaglove.com/

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.

Skin and Body Protection

Lab coats must be worn and be appropriately sized for the individual and buttoned to their full length. Laboratory coat sleeves must be of sufficient length to prevent skin exposure while wearing gloves. Full length pants and closed-toe shoes must be worn at all times by all individuals that are occupying the laboratory area. The area of skin between the shoe and ankle should not be exposed.

Hygiene Measures

Wash thoroughly and immediately after handling. Remove any contaminated clothing and wash before reuse**.**

Engineering Controls

Handle using a chemical fume hood with good ventilation and electrically grounded lines and equipment.

First Aid Procedures

If inhaled

Move into the fresh air. Seek medical attention immediately.

In case of skin contact

Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash any contaminated clothing before reuse. Thoroughly clean shoes before reuse. Seek medical attention immediately.

In case of eye contact

Check for and remove any contact lenses. Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician. Seek immediate medical attention.

If swallowed

Do NOT induce vomiting unless directed by medical personnel. Never give anything by mouth to an unconscious person. Seek medical attention immediately.

Special Handling and Storage Requirements

Precautions for safe handling: Avoid contact with skin and eyes and inhalation. Keep away from sources of ignition. Avoid heat and shock or friction when handling.

Conditions for safe storage: Keep container tightly closed in a cool, dry, and well-ventilated location. Keep away from incompatible materials and conditions. Store in original container. Store away from heat sources and in a flame proof area. Keep cool and protect from sunlight.

Incompatible with the Following Materials

Strong acids and oxidizing agents.

Spill and Accident Procedure

Chemical Spill Dial 911

Spill – Dial **911** and ask for EH&S assistance or call EH&S directly x459-2553.

Chemical Spill on Body or Clothes – Remove clothing and rinse body thoroughly in emergency shower for at least 15 minutes. Seek medical attention if needed. *Notify supervisor and EH&S via 911 immediately.*

Chemical Splash Into Eyes – Immediately rinse eyeball and inner surface of eyelid with water from the emergency eyewash station for 15 minutes by forcibly holding the eye open. Seek medical attention. *Notify supervisor and EH&S via 911 immediately.*

Mucous Membrane Exposure: Flush the affected area for 15 minutes using an eyewash station.

Needlestick/Puncture Injuries – 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/workerscomp/injuryreportinghowto.html

Medical Emergency Dial 911

Life Threatening Emergency, After Hours, Weekends And Holidays – Dial **911**

Non-Life Threatening Emergency – For employees, follow the instructions at the Risk Services website: http://risk.ucsc.edu/workerscomp/injuryreportinghowto.html

Note: All serious injuries must be reported to EH&S as soon as possible.

Decontamination/Waste Disposal Procedure

Contaminated instruments and benches should be decontaminated with soap and water. All waste and contaminated disposables should be disposed of as hazardous waste according to the guidelines below.

Waste Procedures

General hazardous waste management guidelines: http://ehs.ucsc.edu/programs/waste-management/index.html

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

Safety Data Sheet (SDS) Location

Online SDSs can be accessed at: http://www.ucmsds.com/?X .

NOTE

Any deviation from this Procedural/Chemical Handling SOP requires approval from PI.

Documentation of Training (signature of all users is required)

- Prior to conducting any work with **Ammonium metavanadate**, 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 read and understand the content of this SOP: _____

Name	Signature	Date

(*Add further signature lines as necessary*)

Revision History

Version	Date	Revision Author	Summary of Changes
1	12/13/2012	Tianyu Liu	Initial SOP author
2	12/14/12	Lisa Wisser	Update template
3	12/17/12	Tina Ross	Chem review and expand process info
4	12/17/12	Lisa Wisser	Revise tox data, PPE, edit format
5	12/18/12	Tina Ross	Chem review, font edit