Standard Operating Procedure

**Trimethylaluminum (TMA)**

*This is an SOP template and is not complete until: 1) lab specific information is entered into the box below 2) lab specific protocol/procedure is added to the protocol/procedure section and
3) 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*.
Refer to instructions for assistance.

|  |  |
| --- | --- |
| **Department:** | Click here to enter text. |
| **Date SOP was written:** | Click here to enter a date. |
| **Date SOP was approved by PI/lab supervisor:** | Click here to enter a date. |
| **Principal Investigator:** | Click here to enter text. |
| **Internal Lab Safety Coordinator/Lab Manager:** | Click here to enter text. |
| **Lab Phone:** | Click here to enter text. |
| **Office Phone:** | Click here to enter text. |
| **Emergency Contact:** | Click here to enter text. |
| *(Name and Phone Number)* |
| **Location(s) covered by this SOP:** | Click here to enter text. |
| *(Building/Room Number)* |

**Type of SOP:** [ ]  Process [x] Hazardous Chemical [x]  Hazardous Class

**Purpose**

Trimethylaluminum (TMA) is pyrophoric, strong water reactive and its vapors may form explosive mixture with air. If not handled properly, this can pose a serious threat to the health and safety of laboratory personnel, emergency responders and chemical waste handlers. This SOP helps to understand how to properly store, handle and dispose of Trimethylaluminum.

TMA is mainly used for the production of methylaluminoxane, an activator for Ziegler-Natta catalysts for olefin polymerisation. TMA is also employed as a methylation agent. Tebbe’s reagent, which is used for the methylenation of esters and ketones, is prepared from TMA. TMA is often released from sounding rockets as a tracer in studies of upper atmospheric wind patterns. TMA is also used in semiconductor fabrication to grow thin film, high-k dielectrics such as Al2O3 via the processes of Chemical Vapor Deposition (CVD) or Atomic Layer Deposition. TMA forms a complex with the tertiary amine DABCO, which is safer to handle than TMA itself.

**Physical & Chemical Properties/Definition of Chemical Group**

CAS#: 75-24-1

Class: Pyrophoric, water reactive & highly flammable

Molecular Formula: C3H9Al

Form (physical state): Liquid

Color: Under ambient conditions, this is a colorless liquid.

Boiling point: 257°F (125°C)

**Potential Hazards/Toxicity**

DANGER! Pyrophoric, flammable liquid and vapor.

Ignites on contact with air.

Harmful if inhaled or swallowed.

May cause eye, skin, and respiratory tract burns.

Reacts violently with water or atmospheric moisture.

Decomposes into irritating dust that may cause liver and kidney damage.

**Potential Health Effects**

**Inhalation:** Reaction with moist tissues causes burns. Residual dusts may cause irritation

of the mouth nose, and throat.

**Skin Contact:** May cause irritation or burns.

**Swallowing:** Reaction of liquid with moisture may cause severe burns of the mouth,

esophagus, and stomach lining. Residual dusts have been implicated in kidney and liver

damage in laboratory animals.

**Eye Contact:** Contact with the liquid may cause severe eye burns. Dusts and vapor may

irritate the eyes.

**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 Permissible Exposure Limit (PEL) has exceeded or when there is a possibility that PEL 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 PEL)
* As PPE in the event of a chemical spill clean-up process

Lab personnel intending to use/wear a respirator mask must be trained and fit-tested by ORS and should contact occhealt@uga.edu. This is a UGA requirement described in more detail in the [UGA Respiratory Protection Plan](https://esd.uga.edu/sites/default/files/respiratoryprotection.pdf) and supported by the [Office of Research Occupational Health and Safety Program](https://research.uga.edu/ohsp/).

**Hand Protection**

Gloves recommended when handling Trimethylaluminum (TMA): Fire resistant gloves.

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

Refer to glove selection chart 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**

Safety goggles/face shield (ANSI approved)

**Skin and Body Protection**

Closed-toe shoes, fire resistant lab coat (100% cotton based) and cotton attire

**Hygiene Measures**

Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling TMA.

**Engineering Controls**

Use only in a closed system. This material is air and moisture sensitive. It should be maintained under a dry, inert atmosphere and used in an enclosed device such as a glove box.

**First Aid Procedures**

**If inhaled**

Immediately remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, qualified personnel may give oxygen. Call a physician.

**In case of skin contact**

Immediately flush exposed areas with water for 15 minutes (using Safety Shower). In case of

massive exposure, remove contaminated clothing while showering with water. Do not remove

any clothing that is stuck to the skin. Call a physician.

**In case of eye contact**

Immediately flush eyes thoroughly with plenty of water for at least 15 minutes (using Emergency Eyewash). Hold the eyelids open and away from the eyeballs to ensure that all surfaces are flushed thoroughly. See a physician, preferably an ophthalmologist, immediately.

**If swallowed**

If victim is conscious, wash out mouth with water. Call a physician.

***Notes to physician:*** *There is no specific antidote. Treatment of overexposure should be*

*directed at the control of symptoms and the clinical condition of the patient.*

**Special Handling and Storage Requirements**

**PRECAUTIONS TO BE TAKEN IN HANDLING: *Flammable liquid and vapor ignite spontaneously in air.*** Do not breathe vapor. Use only with adequate ventilation or respiratory protection. Do not get liquid or vapor in eyes, on skin, or on clothing. Keep away from air, water or moisture, oxidizing agents, and other flammables. Use only spark-proof tools and explosion-proof equipment. Keep away from heat, sparks, and open flame. ***Do not eat, drink, or smoke in areas where this material is stored or used.*** After working with this material, wash face and hands thoroughly with soap and water before eating drinking, smoking, applying cosmetics, or using the toilet. Have safety showers and eyewash fountains immediately available. Protect containers from damage. ¶ **PRECAUTIONS TO BE TAKEN IN STORAGE:** Store in a cool, dry place away from direct sunlight. Keep storage containers tightly closed. This material must be handled and stored under a blanket of nitrogen and used only in a closed system. Store away from oxygen, chlorine, and other oxidizers. Firmly secure containers upright to keep them from falling or being knocked over. Keep valves tightly closed. Post “No Smoking or Open Flames” signs in storage and use areas. There must be no sources of ignition. Store only where temperature will not exceed 125°F (52°C). Store full and empty containers separately. Use a first-in, first-out inventory system to prevent storing full containers for long periods. **CONDITIONS TO AVOID:** High temperatures, sparks, and flames. **INCOMPATIBLE MATERIALS:** Air, water, moisture, oxidizers **HAZARDOUS DECOMPOSITION PRODUCTS:** Aluminum oxide dust, CO, CO2 **Salient Points to Remember** Self-contained breathing apparatus and protective clothing must be worn by rescue workers.

**Spill and Accident Procedure**

**Chemical Spill Dial 911**

**24-7 On-Call Response to Research, Environment, Health or Safety Concerns Dial 2-5561 from a campus phone or 706-542-5561 from a non-campus line.**

**Spill** – Follow the procedures set out in the [UGA Chemical and Laboratory Safety Manual.](http://research.uga.edu/docs/units/safety/manuals/Chemical-Laboratory-Safety-Manual.pdf)

[If there are any chemical-specific protocols for responding to a spill, insert them here or mark “none”:]

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# **Medical Emergency Dial 911**

**Life Threatening Emergency, After Hours, Weekends And Holidays** – Dial **911** or the emergency phone numbers listed at the beginning of the UGA Chemical and Laboratory Safety Manual

*Note: All incidents that result in an injury or property damage must be reported to ORS / ESD using a University Incident/Accident Report.*

**Non-Life Threatening Emergency** – Follow the instructions in the UGA Chemical and Laboratory Safety Manual.

*Note: All incidents that result in an injury or property damage must be reported to ORS / ESD using a University Incident/Accident Report.*

**Decontamination/Waste Disposal Procedure**

**For general hazardous waste disposal procedures, see Appendix H of the UGA Chemical and Laboratory Safety Manual.**

**Chemical Specific Procedures: [to be inserted or marked as “none”]**

**Safety Data Sheet (SDS) Location**

UGA personnel can access Online SDS through a link in the upper left corner of the ESD home page (<https://esd.uga.edu>) and logging in by using their UGA email user name and password.

**Protocol/Procedure (Add lab specific Protocol/Procedure here)**

Click here to enter text.

**NOTE**

Any deviation from this SOP requires approval from PI.

**Documentation of Training** (signature of all users is required)

* Prior to conducting any work with Trimethylaluminum (TMA) , 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.
* The Principal Investigator must provide his/her laboratory personnel with a copy of this SOP and access to 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 12 months.

**Principal Investigator SOP Approval**

Print name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Signature\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Approval Date:

I have read and understand the content of this SOP:

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| --- | --- | --- |
| **Name** | **Signature** | **Date** |
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