

Risk Assessment Form (3)

Must be completed before experimentation.

Student's Name(s) Ethan Eisenberg and Jack Cox

Title of Project Stability Enhancement of Perovskite Solar Cells Using Mixed Cation/Halide Perovskite

To be completed by the Student Researcher(s) in collaboration with Designated Supervisor/Qualified Scientist: (All questions must be answered; additional page(s) may be attached.)

1. List all hazardous chemicals, activities, or devices that will be used; identify microorganisms exempt from pre-approval (see Potentially Hazardous Biological Agent rules).

Acetone, Isopropyl Alcohol, Ethyl Alcohol, Titanium (IV) butoxide, Ethanoic Acid, Acetylacetone, PbI₂, MAI, CsI, FAI, PbBr₂, DMF, DMSO, MABr, TiO₂, Chlorobenzene, UV, Ozone
(please see attachment for details)

2. Identify and assess the risks involved in this project.

Some substances are: highly flammable liquid and vapor, causes serious eye irritation, may cause drowsiness or dizziness, and may cause damage to organs through prolonged or repeated exposure. Some substance can cause skin irritation, skin burns, respiratory irritation or can cause cancer.
(please see attachment for details)

3. Describe the safety precautions and procedures that will be used to reduce the risks.

To minimize risks, gloves, goggles, and lab coats are going to be worn as personal protective equipment. Handling of highly hazardous chemicals will be performed under direct supervision by mentors under the fume hood. Avoid inhalation of vapor or mist. Keep away from sources of ignition - No smoking. Measures will be taken to prevent the buildup of electrostatic charge. For safe storage, the container will be tightly closed in a dry and well-ventilated place.

4. Describe the disposal procedures that will be used (when applicable).

Materials will be disposed according to Stony Brook University policy and under supervision of mentors. For example, organic waste such as acetone will be disposed in appropriate containers required by the chemical safety officer.

5. List the source(s) of safety information.

Safety Data Sheets were obtained from Sigma Aldrich, Flinn Scientific.

To be completed and signed by the Designated Supervisor (or Qualified Scientist, when applicable):

I agree with the risk assessment and safety precautions and procedures described above. I certify that I have reviewed the Research Plan/Project Summary and will provide direct supervision.

Dr. Miriam Rafailovich

Designated Supervisor's Printed Name

Miriam Rafailovich
Signature

07/03/2019

Date of Review (mm/dd/yy)

Dist Prof. Stony Brook University

Position & Institution

516-458-9011

Phone or email contact information

PhD and director of laboratory

Experience/Training as relates to the student's area of research

Stability Enhancement of Perovskite Solar Cells Using Mixed Cation/Halide Perovskite

Students: Ethan Eisenberg and Jack Cox

Risk and Safety:

Safety Data Sheets from ThermoFisher Scientific, Sigma Aldrich, Ozone Solutions, and Ecletic, were used for all the chemicals

Acetone- Highly flammable liquid and vapor, causes serious eye irritation, may cause drowsiness or dizziness, and may cause damage to organs through prolonged or repeated exposure. Gloves, goggles and lab coats will be worn when handling. The acetone will be stored in the flammables area in a tightly closed container, and stored in a well-ventilated place away from heat and sources of ignition. The acetone will be disposed according to official regulations by the chemical safety officer of Stony Brook University.

<https://www.fishersci.com/shop/msdsproxy?productName=AC177170010&productDescription=ACETONE>

Isopropyl Alcohol- Highly flammable liquid and vapor. May cause serious eye irritation, drowsiness, or dizziness. Gloves, goggles and lab coats will be worn when handling. When storing, the isopropyl alcohol will be kept away from sources of ignition, and there will be no smoking. Measures will be taken to prevent the build up of electrostatic charge. The container will be tightly closed in a dry and well-ventilated place, and containers that are opened must be carefully resealed and kept upright to prevent leakage. The isopropyl alcohol will be disposed according to the official regulations by the chemical safety officer of Stony Brook University.

<https://www.sigmaaldrich.com/MSDS/MSDS/DisplayMSDSPage.do?country=US&language=en&productNumber=W292907&brand=ALDRICH&PageToGoToURL=https%3A%2F%2Fwww.sigmaaldrich.com%2Fcatalog%2Fproduct%2Faldrich%2Fw292907%3Flang%3Den>

Ethyl Alcohol- Highly flammable liquid and vapor. Causes serious eye irritation, damage to organs, and damage to organs through prolonged or repeated exposure. Personal protective equipment such as gloves, goggles, and lab coats will be worn in the lab. Adequate ventilation will be ensured. The ethyl alcohol will not get in eyes, skin, or clothing, and will be avoided from ingesting and inhaling. For storage, containers will be kept in a tightly closed in a dry, cool and well-ventilated place. Containers will also be kept away from heat and sources of ignition. The ethyl alcohol will be disposed according to the official regulations by the chemical safety officer of Stony Brook University.

<https://www.fishersci.com/msdsproxy%3FproductName%3DA405P4%26productDescription%3DETHANOL%2BAHYD%2BHISTO%2B4L%26catNo%3DA405P-4%2B%26vendorId%3DVN00033897%26storeId%3D10652>

Titanium (IV) butoxide- Flammable liquid and vapor. Causes skin irritation and serious eye damage. May also cause respiratory irritation, drowsiness, or dizziness. . Avoid contact with skin and eyes. Avoid inhalation of vapor or mist. Keep away from sources of ignition - No smoking. Measures will be taken to prevent the buildup of electrostatic charge. For safe storage, the container will be tightly closed in a dry and well-ventilated place. Proper equipment will be worn such as gloves, goggles, and lab coats. Containers which are opened must be carefully resealed and kept upright to prevent leakage. The Titanium (IV) butoxide will be disposed according to the official regulations by the chemical safety officer of Stony Brook University.

<https://www.sigmaaldrich.com/MSDS/MSDS/DisplayMSDSPage.do?country=US&language=en&productNumber=244112&brand=ALDRICH&PageToGoToURL=https%3A%2F%2Fwww.sigmaaldrich.com%2Fcatalog%2Fproduct%2Faldrich%2F244112%3Flang%3Den>

Ethanoic Acid- Flammable liquid and vapor. Causes severe skin burns and eye damage. May be harmful if swallowed. Toxic if inhaled. Harmful if in contact with skin. The ethanoic acid will be stored in a cool location where ventilation will be provided for containers. Proper protection equipment will be worn such as gloves, goggles, and lab coats. Storage near extreme heat, ignition sources, or an open flame will be avoided. The container will be tightly sealed and if opened, resealed and kept upright to prevent leakage. The ethanoic acid will be disposed according to the official regulations by the chemical safety officer of Stony Brook University.

https://betastatic.fishersci.com/content/dam/fishersci/en_US/documents/programs/education/regulatory-documents/sds/chemicals/chemicals-a/S25118.pdf

Acetylacetone- Flammable liquid and vapor. Harmful if swallowed. Toxic if in contact with skin or inhaled. Container will be tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage. Proper laboratory equipment such as gloves and goggles will be worn. Acetylacetone will be disposed according to the official regulations by the chemical safety officer of Stony Brook University

<https://www.sigmaaldrich.com/MSDS/MSDS/DisplayMSDSPage.do?country=US&language=en&productNumber=A3511&brand=SIGMA&PageToGoToURL=https%3A%2F%2Fwww.sigmaaldrich.com%2Fcatalog%2Fproduct%2Fsigma%2Fa3511%3Flang%3Den>

Note: Discontinued Chemical as shown on the Sigma Aldrich Website.

PbI₂- Harmful if swallowed or if inhaled. May cause cancer. May cause damage to organs through prolonged or repeated exposure. Gloves, goggles, and lab coats will be worn. Container will be kept tightly closed in a dry and well-ventilated place. PbI₂ will be disposed according to the official regulations by the chemical safety officer of Stony Brook University.

<https://www.sigmaaldrich.com/MSDS/MSDS/DisplayMSDSPage.do?country=US&language=en&productNumber=203602&brand=ALDRICH&PageToGoToURL=https%3A%2F%2Fwww.sigmaaldrich.com%2Fcatalog%2Fsearch%3Fterm%3DPbI2%26interface%3DAI%26N%3D0%26mode%3Dpartialmax%26lang%3Den%26region%3DUS%26focus%3Dproduct>

MAI- Harmful if swallowed. Causes skin irritation. Causes serious eye irritation. May cause respiratory irritation. Will be kept in a tightly closed container and in a dry and well-ventilated place. Gloves, goggles, and lab coats will be worn. MAI will be disposed according to the chemical safety officer of Stony Brook University.

<https://www.sigmaaldrich.com/MSDS/MSDS/DisplayMSDSPage.do?country=US&language=en&productNumber=793493&brand=ALDRICH&PageToGoToURL=https%3A%2F%2Fwww.sigmaaldrich.com%2Fcatalog%2Fproduct%2Faldrich%2F793493%3Flang%3Den>

CsI- Causes skin irritation. May cause an allergic skin reaction. Causes serious eye irritation. May cause respiratory irritation. Gloves, goggles, and lab coats will be worn. Will be kept in a tightly closed container and in a dry and well-ventilated place. Will be disposed according to the chemical safety officer of Stony Brook University

<https://www.sigmaaldrich.com/MSDS/MSDS/DisplayMSDSPage.do?country=US&language=en&productNumber=203033&brand=ALDRICH&PageToGoToURL=https%3A%2F%2Fwww.sigmaaldrich.com%2Fcatalog%2Fproduct%2Faldrich%2F203033%3Flang%3Den>

FAI- Harmful if swallowed. Causes skin irritation Causes serious eye irritation. May cause respiratory irritation Gloves, goggles, and lab coats will be worn. Will be kept in a tightly closed container in a dry, and well-ventilated place. Will be disposed according to the chemical safety officer of Stony Brook University.

<https://www.sigmaaldrich.com/MSDS/MSDS/DisplayMSDSPage.do?country=US&language=en&productNumber=806048&brand=ALDRICH&PageToGoToURL=https%3A%2F%2Fwww.sigmaaldrich.com%2Fcatalog%2Fproduct%2Faldrich%2F806048%3Flang%3Den>

PbBr₂- Harmful if swallowed or if inhaled. May cause cancer. May cause damage to organs through prolonged or repeated exposure. Gloves, goggles, and lab coats will be worn. Will be kept in a tightly closed container in a dry, and well-ventilated place. Will be disposed according to the chemical safety officer of Stony Brook University.

<https://www.sigmaaldrich.com/MSDS/MSDS/DisplayMSDSPage.do?country=US&language=en&productNumber=398853&brand=ALDRICH&PageToGoToURL=https%3A%2F%2Fwww.sigmaaldrich.com%2Fcatalog%2Fproduct%2Faldrich%2F398853%3Flang%3Den>

DMF- Flammable liquid and vapor. Harmful in contact with skin or if inhaled. Causes serious eye irritation. Gloves, goggles, and lab coats will be worn. Will be kept in a tightly closed container in a dry, and well-ventilated place. Containers which are opened will be carefully resealed and kept upright to prevent leakage. Will be disposed according to the chemical safety officer of Stony Brook University.

<https://www.sigmaaldrich.com/MSDS/MSDS/DisplayMSDSPage.do?country=US&language=en&productNumber=D4551&brand=SIGMA&PageToGoToURL=https%3A%2F%2Fwww.sigmaaldrich.com%2Fcatalog%2Fproduct%2Fsigma%2Fd4551%3Flang%3Den>

DMSO- Combustible liquid. Gloves, goggles, and lab coats will be worn. Will be kept in a tightly closed container in a dry, and well-ventilated place. Will be disposed according to the chemical safety officer of Stony Brook University.

<https://www.sigmaaldrich.com/MSDS/MSDS/DisplayMSDSPage.do?country=US&language=en&productNumber=276855&brand=SIAL&PageToGoToURL=https%3A%2F%2Fwww.sigmaaldrich.com%2Fcatalog%2Fproduct%2Fsial%2F276855%3Flang%3Den>

MABr- Harmful if swallowed. Causes skin irritation. Causes serious eye irritation. May cause respiratory irritation. Gloves, goggles, and lab coats will be worn. . Will be kept in a tightly closed container in a dry, and well-ventilated place. Will be disposed according to the chemical safety officer of Stony Brook University.

<https://www.sigmaaldrich.com/MSDS/MSDS/DisplayMSDSPage.do?country=US&language=en&productNumber=806498&brand=ALDRICH&PageToGoToURL=https%3A%2F%2Fwww.sigmaaldrich.com%2Fcatalog%2Fproduct%2Faldrich%2F806498%3Flang%3Den>

TiO₂- Not a hazardous substance or mixture. Nonetheless, gloves, goggles, and lab coats will be worn. Will be kept in a tightly closed container in a dry, and well-ventilated place. Will be disposed according to the chemical safety officer of Stony Brook University.

<https://www.sigmaaldrich.com/MSDS/MSDS/DisplayMSDSPage.do?country=US&language=en&productNumber=791326&brand=ALDRICH&PageToGoToURL=https%3A%2F%2Fwww.sigmaaldrich.com%2Fcatalog%2Fsearch%3Fterm%3DTiO2%26interface%3DAI%26N%3D0%2B%26mode%3Dpartialmax%26lang%3Den%26region%3DUS%26focus%3Dproduct>

Chlorobenzene - Flammable liquid and vapor. Causes skin irritation. Harmful if inhaled, Gloves, goggles, and lab coats will be worn. . Kept in a tightly closed container in a dry, and well-ventilated place. Will be kept away from heat and sources of ignition. Will be disposed according to the chemical safety officer of Stony Brook University.

<https://www.fishersci.com/store/msds?partNumber=B2544&productDescription=CHLOROBENZENE+MONO+LAB+4L&vendorId=VN00033897&countryCode=US&language=en>

Activities and Devices

For UV-Ozone Facility:

UV: Causes skin and eye irritation. May cause cancer. Personal protective equipment such as gloves, goggles, and lab coats will be worn. Will be stored in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials and food and drink. Containers will be tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage.

https://www.tapplastics.com/uploads/pdf/E-6800UV_SDS.pdf

Ozone- Oxidizing gas. Causes skin irritation, eye irritation, and is toxic for respiratory systems. Proper safety equipment that include gloves, goggles, and lab coats will be worn in the lab. Ozone will be contained within ozone-resistant tubing and pipes from the generation point to the application point. Any leaks will be repaired before use.

<http://www.ozoneapplications.com/info/Ozone%20Solutions%20MSDS%20Ozone.pdf>

Hot Plate: More than minimal risk of skin irritation and slight burns.

Electrode: More than minimal risk of electric shock. Mentors will oversee use.

X-Ray Diffraction: X-rays may cause a slightly increased chance of cancer. Mentors will oversee use.