

## Risk Assessment Form (3)

Must be completed before experimentation.

Student's Name(s) Eric Kim and Kevin Gu

Title of Project Highly Mesoporous Carbon Aerogel as Catalyst Support in Proton Exchange Membrane Fuel Cells

**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).

Devices: Lindberg Blue M (Tube Furnace), PEMFC Test Station, H<sub>2</sub> Monitor, CO Monitor;  
Chemicals: Resorcinol, H<sub>2</sub>PtCl<sub>6</sub>, Formaldehyde, Sodium Carbonate, Sodium Borohydride, 5% Nafion Solution, Isopropanol Alcohol

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

Resorcinol can cause acute toxicity, skin irritation, and serious eye damage. Chloroplatinic acid hexahydrate can cause severe skin burns & eye damage and may cause allergy or asthma symptoms if inhaled. Formaldehyde is flammable, carcinogenic; it can cause skin irritation and serious eye damage. Sodium Carbonate causes serious eye irritation. Sodium borohydride is toxic; it can ignite spontaneously in contact with water, cause severe skin burns & eye damage, and damage fertility or the unborn child. Prolonged contact with the 5% Nafion solution can cause skin irritation. IPA is flammable and can cause eye irritation. Keep away from heat, and keep the container closed. Due to the high voltages in the tube furnace to generate high temperatures, there is a risk of electrocution, fire, and severe burns.

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

When using resorcinol, chloroplatinic acid, formaldehyde, sodium carbonate, sodium borohydride, Nafion solution, or IPA, wear personal protective equipment such as gloves, goggles, and lab coats, avoid eating or drinking when using chemicals, and wash skin thoroughly after use of the chemical. Chemicals will be kept in safe temperature conditions. Operations on all chemicals will be performed in a fume hood. It is important that Sodium borohydride is handled under inert gas, protected from moisture, and prevented from contacting water. The tube furnace must be grounded with no loose wires, and protective clothing is required. During fuel cell testing, H<sub>2</sub> and CO detectors will be used to monitor the levels of gas. In the case of hazardous H<sub>2</sub> and CO concentrations, alarms will sound, and occupants will leave the room until it is deemed to be safe to return.

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

Sharps will be disposed of in a cardboard container to prevent possible damage and risk. General hazardous chemicals will be sent to a licensed professional waste disposal service or burned in a chemical incinerator with an afterburner and scrubber. Materials related to nanoparticles will be put into plastic bags for disposal to prevent contamination and inhalation of toxic chemicals.

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

The chemical safety information was obtained from [sds.chemicalsafety.com/sds](https://sds.chemicalsafety.com/sds) and [fuelcellstore.com/msds-sheets](https://fuelcellstore.com/msds-sheets) for the respective chemicals.

**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.

<u>Miriam Rafailovich</u>	<u>M. Rafailovich</u>	<u>06/27/19</u>
Designated Supervisor's Printed Name	Signature	Date of Review (mm/dd/yy)

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<u>PhD / Material Science</u>
Experience/Training as relates to the student's area of research