

# Thermally Controlled Phospholipid Enclosure

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## Abstract

The goal of this project is to create a thermal enclosure that can increase the accuracy of phospholipid research. This was accomplished through creating a thermally insulated enclosure in order to maintain the thermal gradient across the observation cell of less than a tenth of a degree. The proposed enclosure will be portable, lightweight, and cheaply manufactured. This solution was also verified through ANSYS Steady-State Thermal to maintain the temperature to within 0.1°C.

## Introduction

### Objectives:

1. Design enclosure for phospholipid research.
2. Confirm design using ANSYS simulation.
3. Test design by monitoring temperature across observation cell.

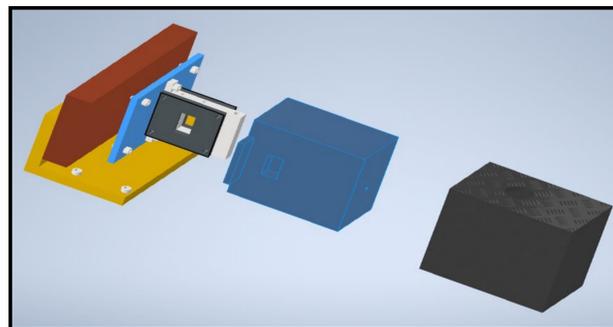


Figure 1: Exploded view of Enclosure

## Methods and Materials

The observation cell is heated and insulated with only two parts, the heating cell and the insulating nylon cover. First the copper heating cell is placed over the observation cell and mounted onto the heated surface, then the nylon cover is placed over the heating cell. These materials were selected particularly for their thermal properties. These materials working in conjunction, would lead to a minimal temperature gradient across Dr. Lurio's observation cell.

### Heating Cell

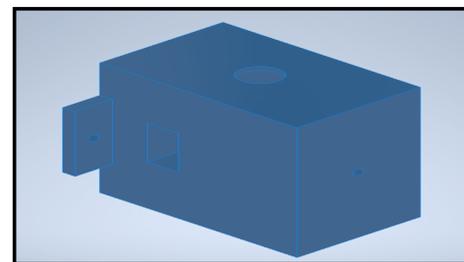


Figure 2: Copper 110 Heating Cell

**Material: Copper 110**

**Thermal conductivity: 398 W/m K**

### Nylon Cover

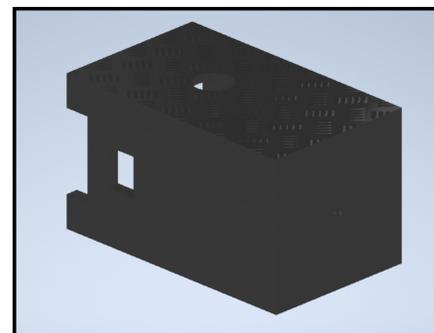


Figure 3: Nylon 06 Thermally Insulating Cover

**Material: Nylon 6**

**Thermal conductivity: .25 W/m K**

## Results/Discussion

Using ANSYS simulation, the design was confirmed to minimize the temperature gradient to .6°C.

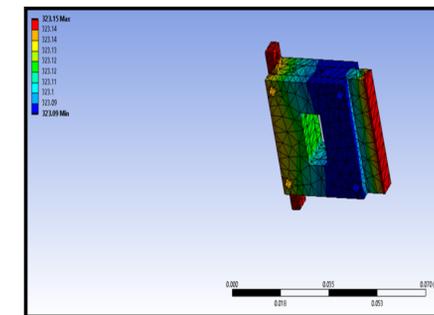


Figure 4: ANSYS Simulation

## Conclusions

Overall this project focused on creating an enclosure that maintains the temperature around and inside the designated fixture. Through the help of a proportional integral derivative or (PID) control and computer simulations, it was possible to verify that using the thermal enclosure, the temperature gradient was maintained and controlled to within 0.01°C. Upon completion, this project will assist in the research of phospholipid structures for Dr. Laurence Lurio.

## Acknowledgements

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