Small Solar Cooker

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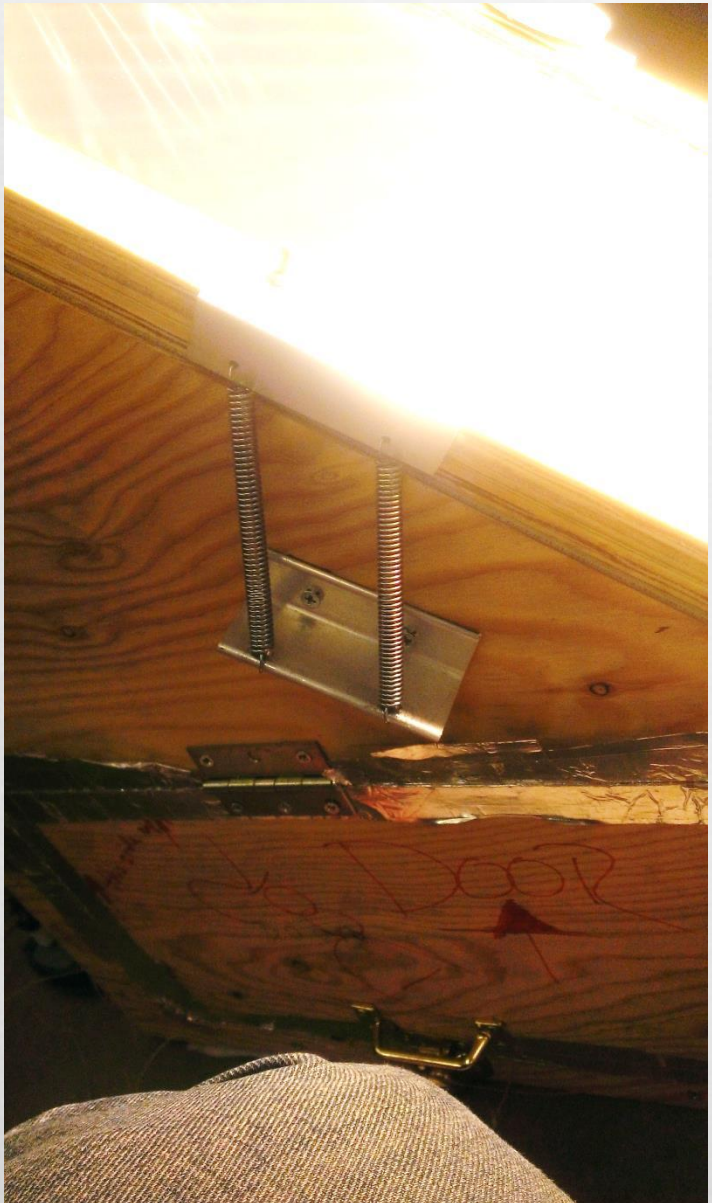
Introduction

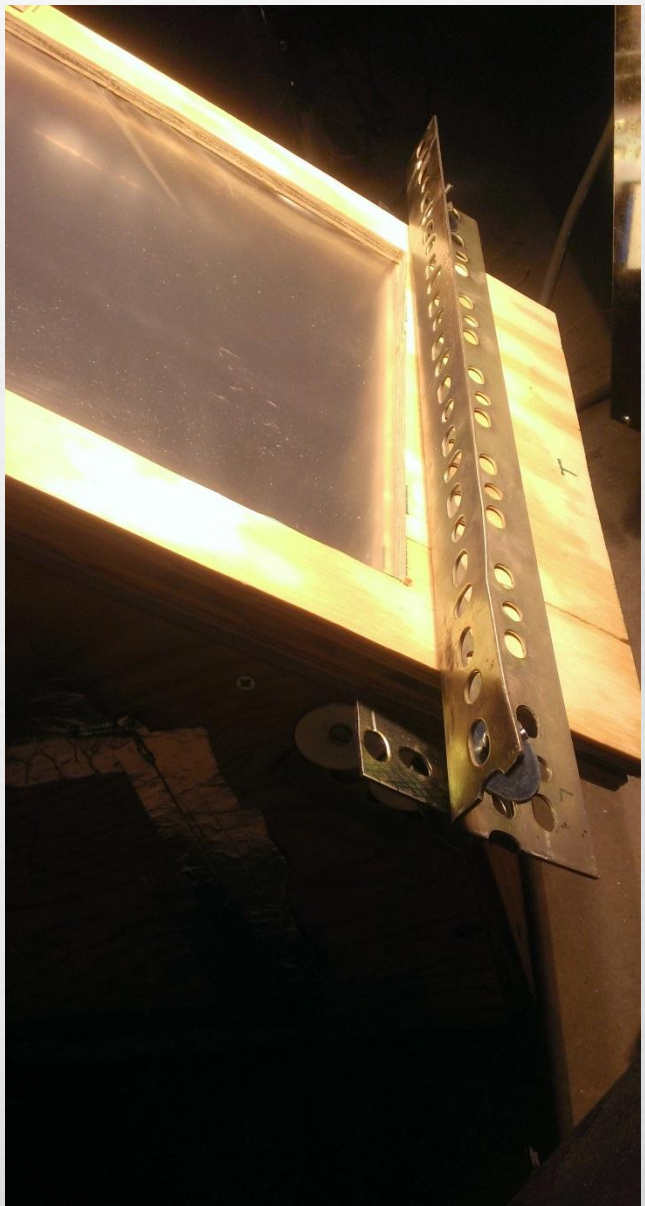
- The team has two solar ovens for use in the city of Ithaca.
- Each oven has a trapezoidal shape with approximately a 42-45 degree inclination.
- Our focus this semester was to find an optimal glazing material configuration.

Goals

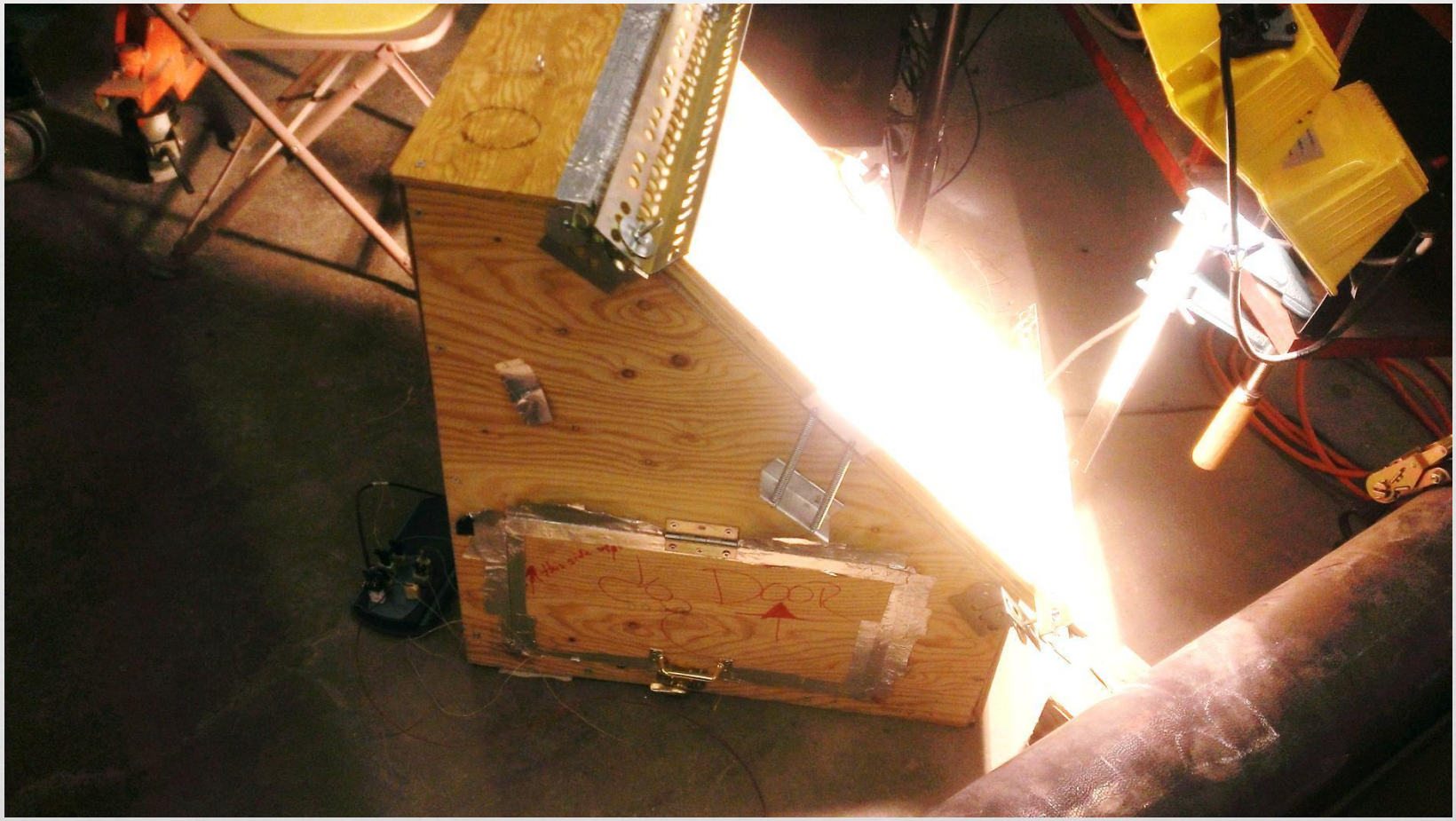
- Run tests on various glazing materials
- Make a conclusion about the best glazing configuration

Testing Apparatus





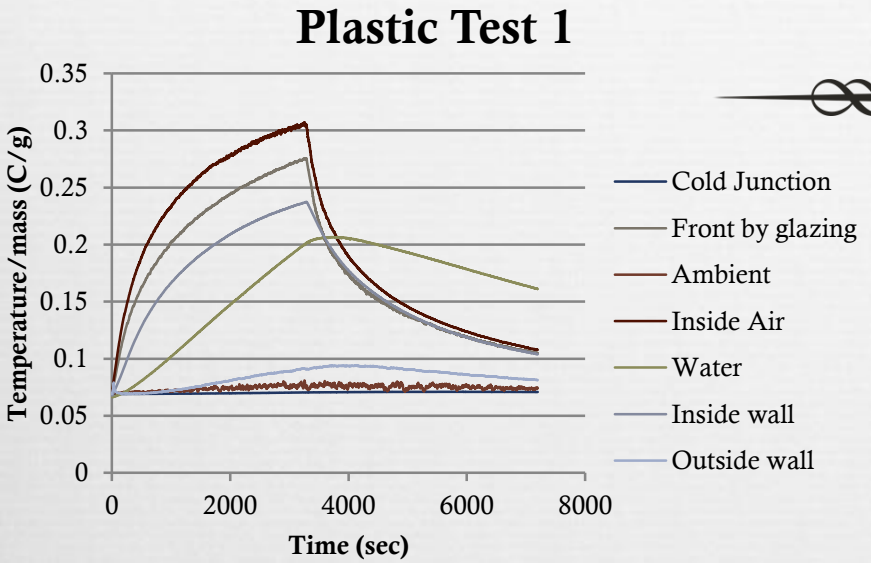
Test Oven



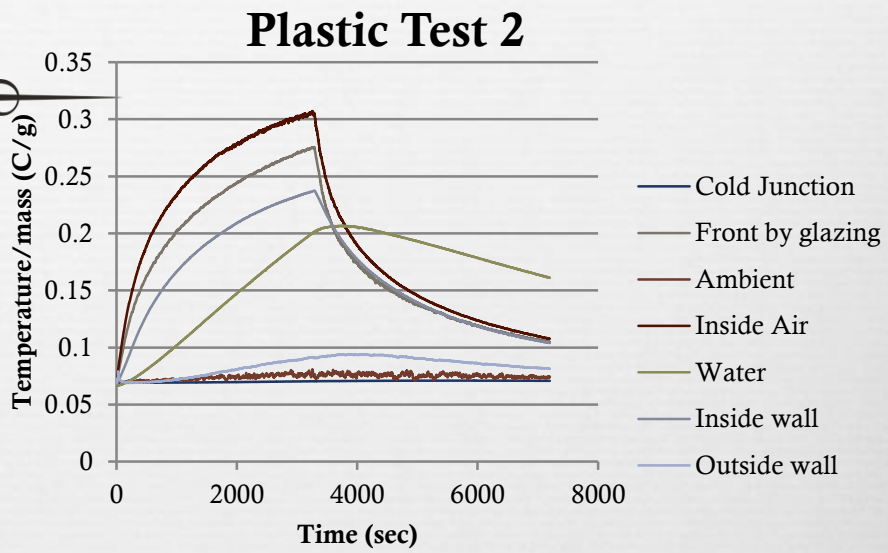
Materials

- Polypropylene Lined Smooth Plastic .03 inch
- Polypropylene Lined Smooth Plastic and Reynolds Oven Bag on outside
- Oven Bag and Polypropylene Lined Smooth Plastic on outside
- Hard Plastic single paned .125 inch
- Reynolds Oven Bag double paned

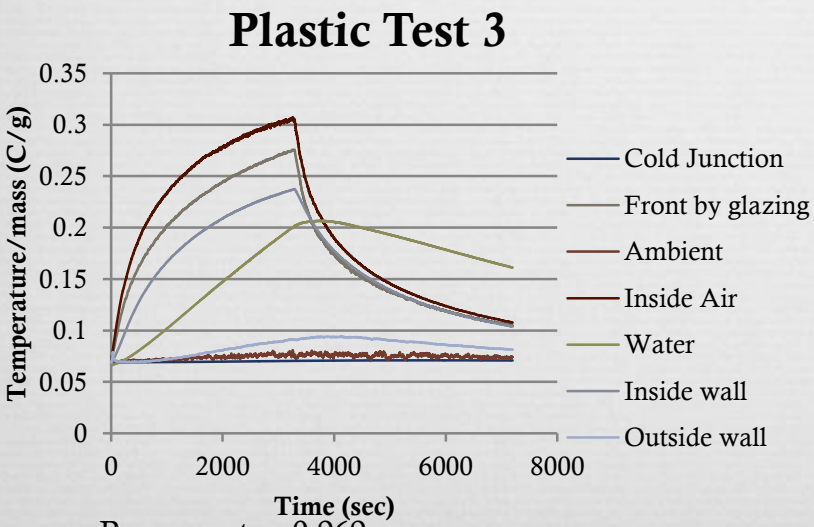
Polypropylene Lined Smooth Plastic



Average Pyranometer: 0.856



Average Pyranometer: 0.921



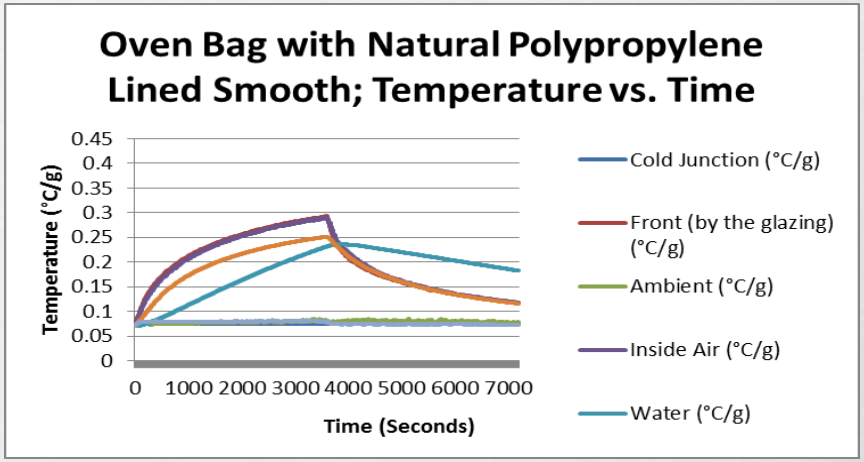
Average Pyranometer: 0.969

	Average	Std. dev
Max Temperature/Gram (Water) (C/gram)	0.273	0.0126
Pyrometer reading (watt/m^2)	0.945	0.0335
Final Temperature (Water) (C/gram)	0.216	0.00711

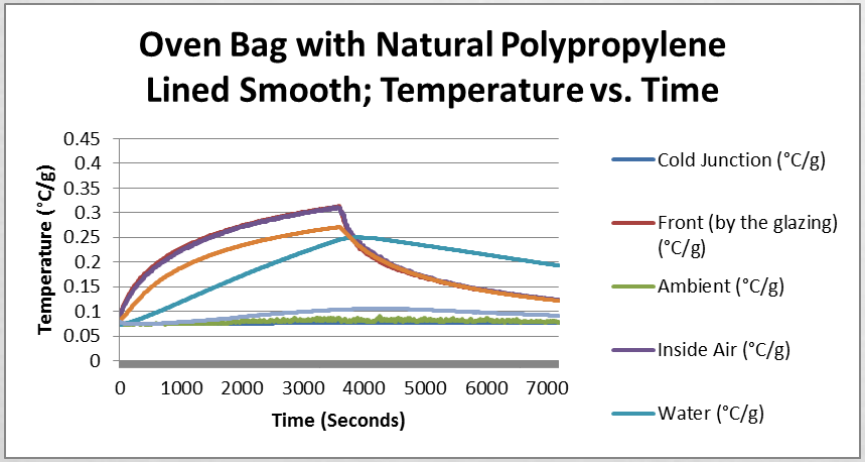
Results: Oven Bag with Natural Polypropylene Lined Smooth Inside

- Thickness of sheet: .03 inch
- Average maximum temperature: .228 °C/g
- Standard Dev. maximum temperature: .040 °C/g
- Average end temperature: .190 °C/g
- Standard Dev. end temperature: .007 °C/g
- Average pyranometer reading: .844 watts/m^2
- Standard Dev. pyranometer reading: .055 watts/m^2

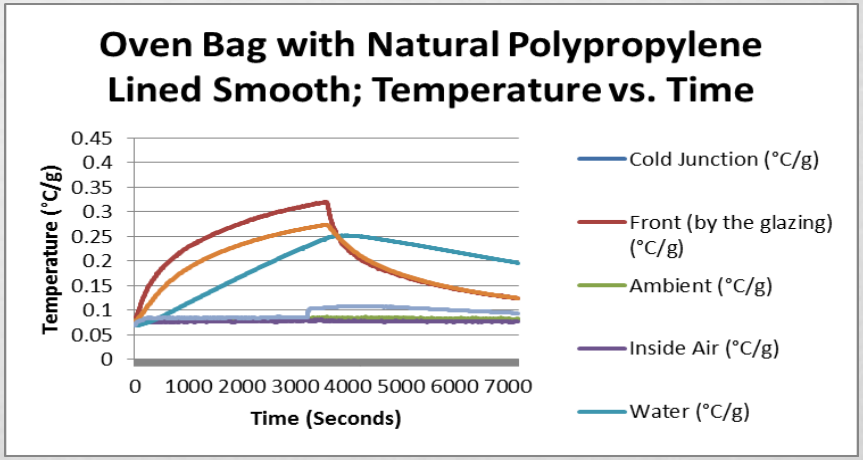
Trial #2 Pyranometer: .86 watts/m^2



Trial #1 Pyranometer: .78 watts/m^2

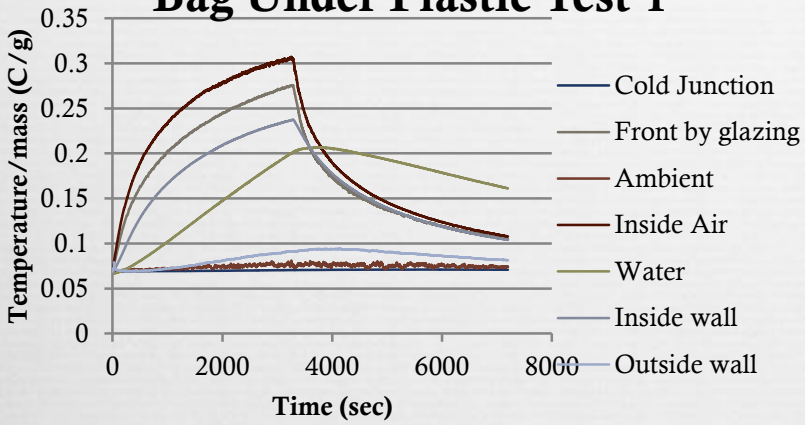


Trial #3 Pyranometer: .89 watts/m^2



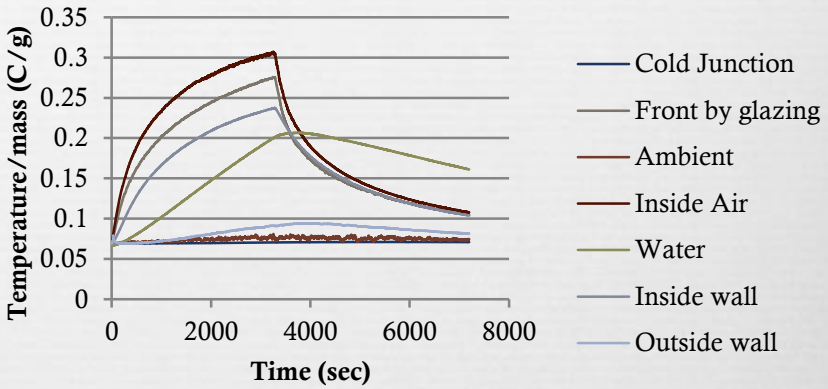
Oven Bag with Polypropylene Plastic Outside

Bag Under Plastic Test 1



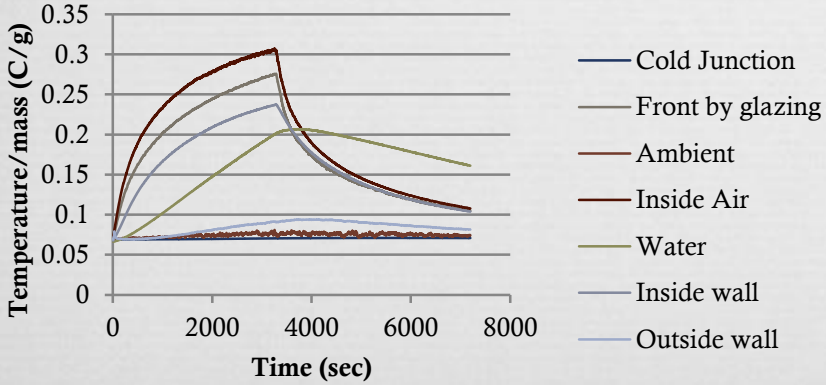
Average Pyranometer: 0.839

Bag Under Plastic Test 2



Average Pyranometer: 0.937

Bag Under Plastic Test 3



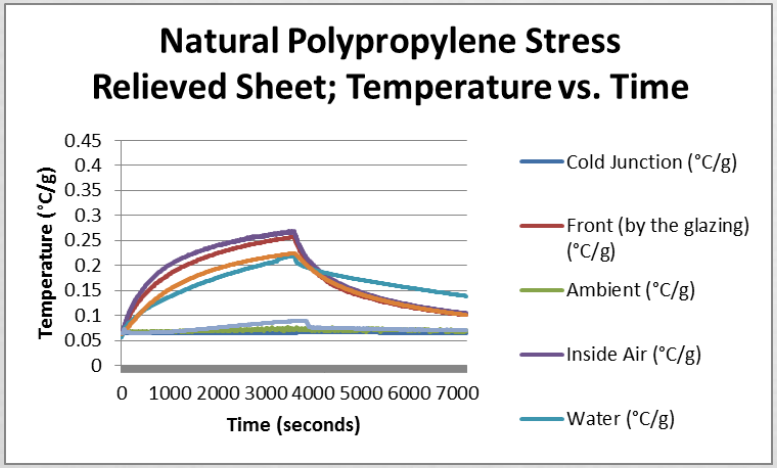
Average Pyranometer: 0.862

	Average	Std. dev
Max Temperature/Gram (Water) (C/gram)	0.255	0.0448
Pyrometer reading (watt/m^2)	0.879	0.0514
Final Temperature (Water) (C/gram)	0.189	0.02169

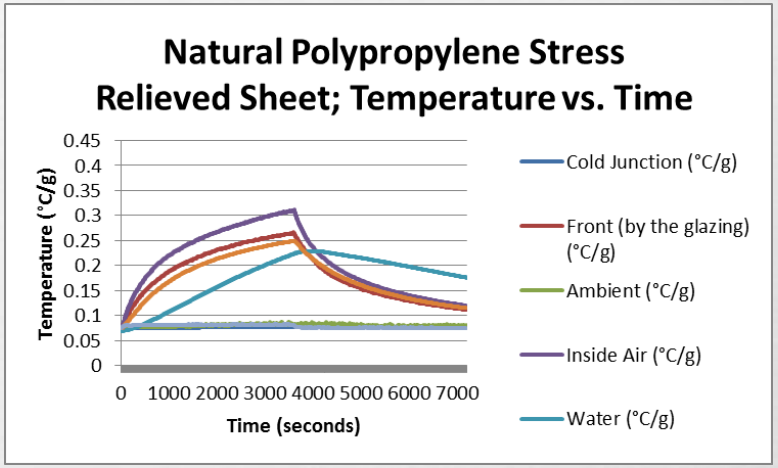
Results: Natural Polypropylene Stress Relieved Sheet

- Thickness of sheet: .125 inch
- Average maximum temperature: .226 °C/g
- Standard Dev. maximum temperature: .005°C/g
- Average end temperature: .182°C/g
- Standard Dev. end temperature: .045°C/g
- Average pyranometer reading: .890 watts/m^2
- Standard Dev. pyranometer reading: .015 watts/m^2

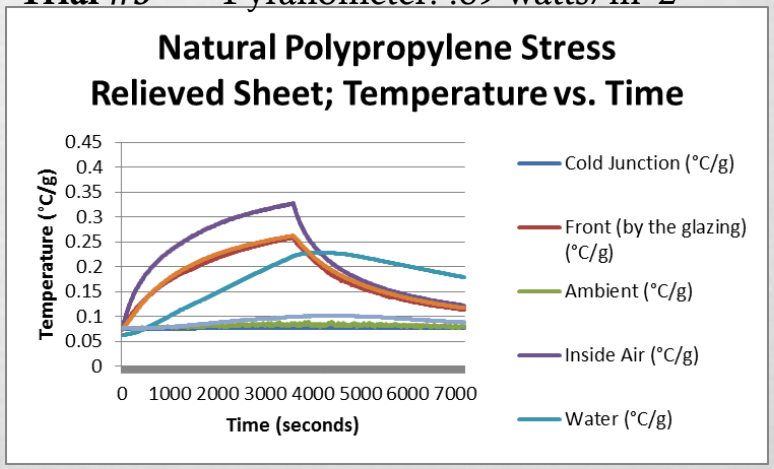
Trial #1 Pyranometer: .88 watts/m^2



Trial #2 Pyranometer: .91 watts/m^2



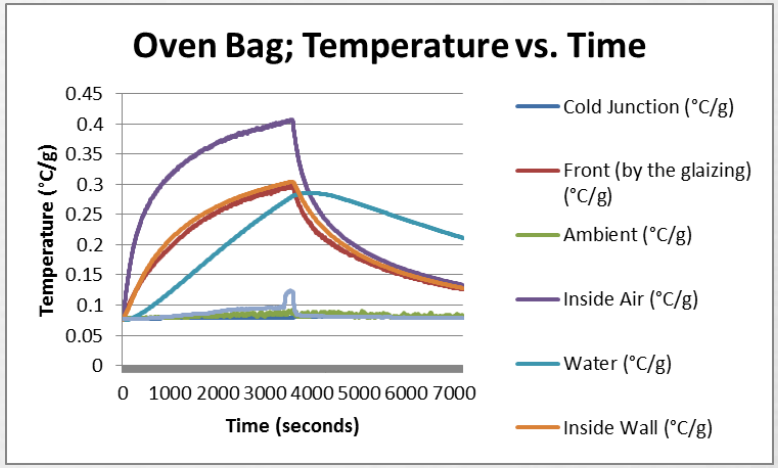
Trial #3 Pyranometer: .89 watts/m^2



Results: Reynolds Oven Bag

- Average maximum temperature: .297°C/g
- Standard Dev. maximum temperature: .035 °C
- Average end temperature: .213°C/g
- Standard Dev. end temperature: .012°C/g
- Average pyranometer reading: .908 watts/m^2
- Standard Dev. pyranometer reading: .008 watts/m^2

Trial #2 Pyranometer: .90 watts/m^2



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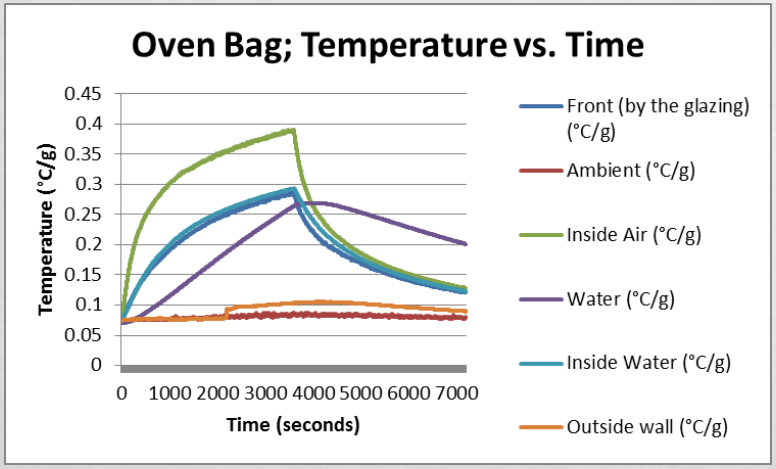

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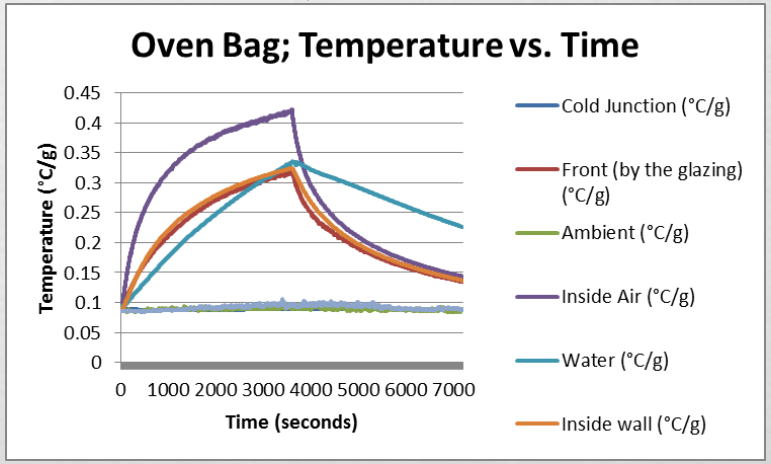

Conclusions

- Oven Bag is the most optimal glazing material
- Polypropylene Lined Smooth Plastic is dependent on thickness
- Transparency is very important
- Combinations of material proved worse than single material

Future Goals

- Complete a final design for a heat basin using the pizza stone material and perhaps the black iron
- Test heat basin(s) outside in the ovens
- Test the optimal configuration for fatigue
- Test double pane of glazing material versus single pane