

Perovskite Solar Cell

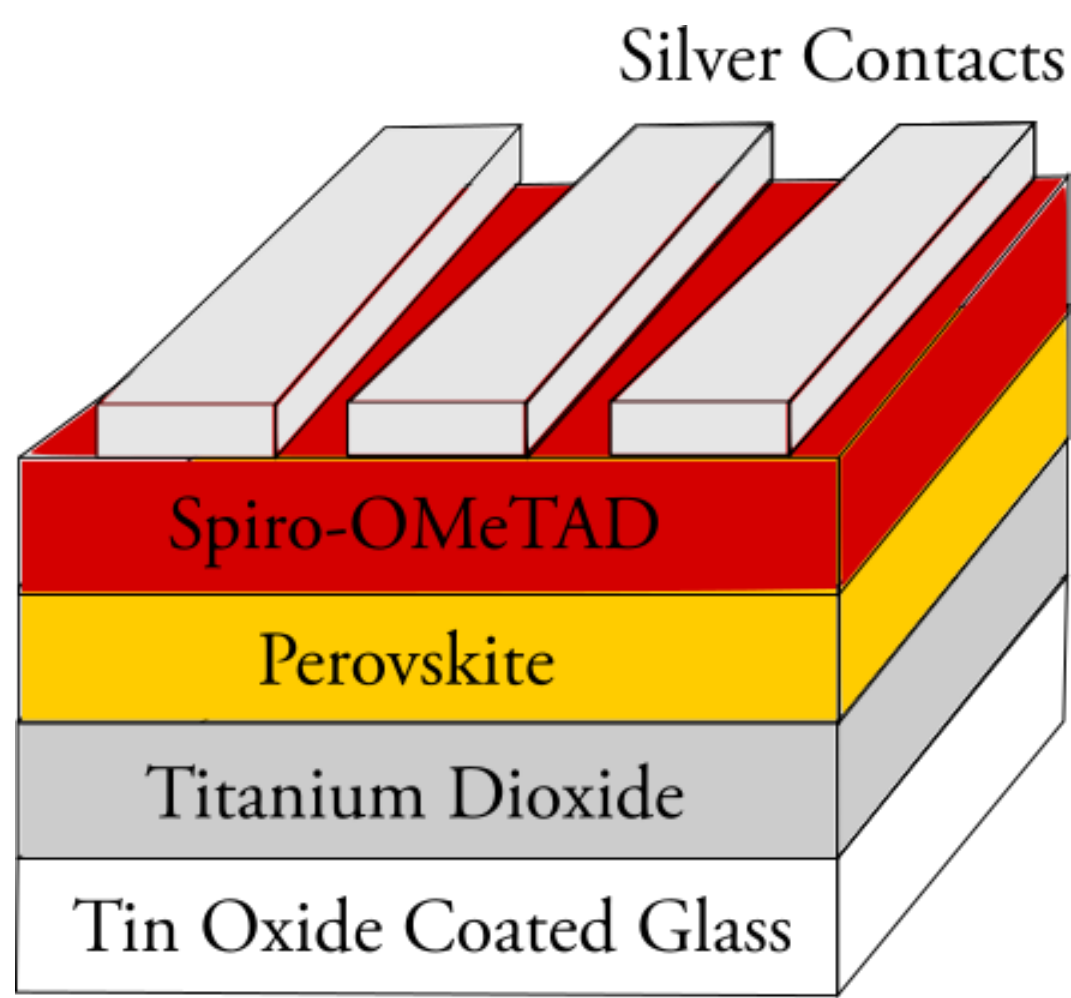
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Introduction

The use of solar cells as a way to get energy has been increasing through the past couple of years. Due to the solar cell being an environmentally friendly method to get energy. Currently right now the majority of solar cells that we use are made out of silicon. Although solar cells do provide a method of obtaining green energy, there are currently some issues with solar cells. Such as the conversion rate of the sunlight that hits the solar cell into electricity is low. To be more precise the average conversion rate of solar cells commercially is around 20%. Another problem with solar cells is the material that it uses which is silicon, takes a lot of energy to manufacture.

The Design Process

A solution to these problems is to use the material perovskite instead of using silicon, since it has a higher proficiency than silicon. Some initial criteria that I have for my solar cell is that it must be able to produce at least 0.6 volt and the material perovskite has to be used in my solar cell. A constraint that I have for my solar cell is that the solar cell would have to be a 1" by 1". My initial design was going to consist of a 1" by 1" tin-oxide coated glass with titanium dioxide on top to prevent the electrical charge from the sunlight escaping out of the cell, titanium dioxide also consists of holes through the solar cell. Then I would spincoat perovskite at top which is a semiconducting crystal that generates holes and electrons in the solar cell. On top of the perovskite layer is the layer of Spiro-OMeTAD and is coated below the silver contacts that is on top of the glass, which is the layer that consists of holes. Then the electrons of the titanium dioxide go to fill in holes in the Spiro-OMeTAD. Afterwards the electrons will go to an electrical wire that is connected to the silver contact and the glass in order to complete a circuit.

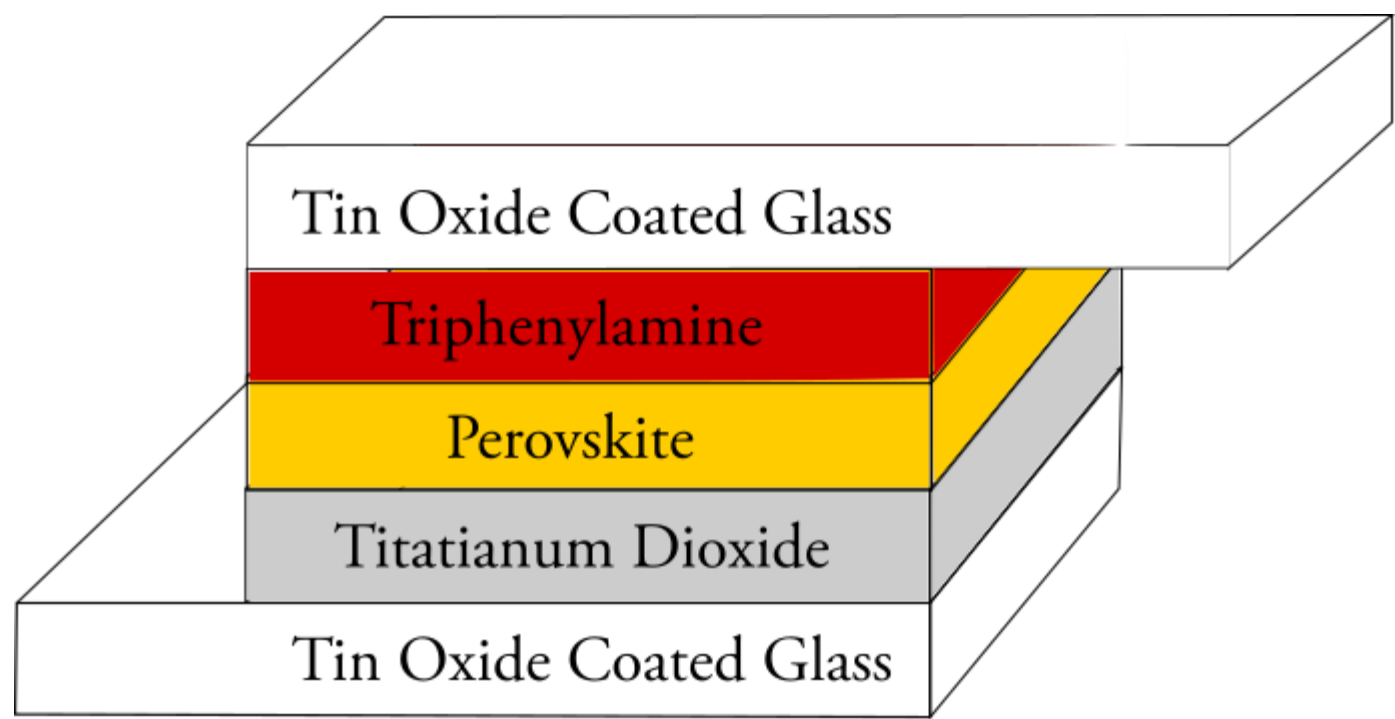


The image above is a model that demonstrates the different layers of my original design.

Design Changes:

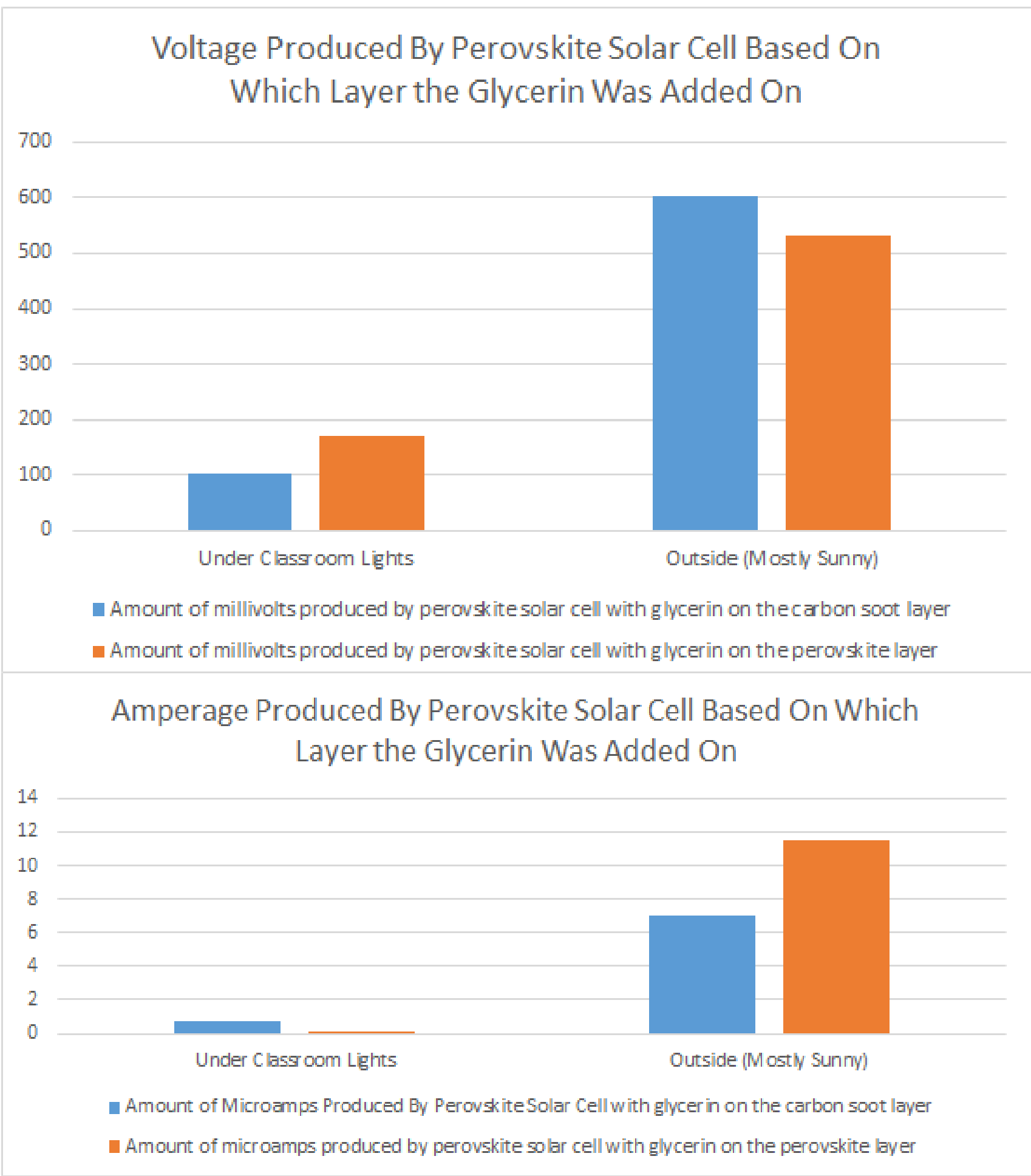
- The first Spiro-OMeTAD layer would be replaced by a triphenylamine layer since it had a cheaper cost.
- The perovskite will be coated onto the titanium coated glass and the triphenylamine be coated onto tin-oxide coated glass. Then have the two glasses sandwich together and sealing the edges with nail polish, to prevent the perovskite from degrading.
- The glass that had the triphenylamine coated onto it also has carbon soot to act as another layer consisting of holes and add another piece of criteria that my solar cell has to produce amperage.

When making my solar cell I decided to use glycerin to be another layer that generates holes and electrons. After I was finished making my first solar cell with the glycerin at the carbon soot layer. I wanted to see if putting the glycerin on the titanium dioxide layer would cause an increase in voltage or amperage in the solar cell.



The image above is a model that demonstrates the different layers of my current design of my solar cell.

Results



Conclusion

- I managed to complete all three of my criteria with the first solar cell that I made with the glycerin being added to the carbon soot layer, while my second solar cell that had the glycerin added to the titanium dioxide layer managed to complete only two thirds of my criteria.
- Both cells were made with perovskite and was able to produce amperage completing ⅔ of my criteria.
- The first solar cell passed the criteria of producing at least 600 millivolts by producing 602 millivolts outdoors.
- The second solar cell produced 532 millivolts outdoors.
- The first solar cell is not better at producing voltage than the second solar cell, since the second solar cell produced more voltage under classroom lights and the days that the solar cells voltage and amperage were measured outdoors were on two separate days skewing the data.
- The second solar cell produce more voltage under classroom lights is because I spread the perovskite better on the second cell than the first cell.
- In the end I did managed to complete all of my criteria for my solar cell, however further testing is needed to see if glycerin placement has any effect on amperage or voltage.

References

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