The Gratzel Cell

New Mexico Adventures in
Supercomputing Challenge
Final Report
April 7, 2004

Team 41
Manzano High School

Robert Helgeson
Stephanie McAllister
Jesse Heath
Patrick McKennon

Steve Schum
Sponsor Teacher

Table of Contents

Executive Summary

Our project is on dye sensitized solar cells or "Gratzel cells". We are trying to recreate an energy converter of a gratzel cell, using different kinds of chlorophyll, which will generate above a 15% power efficiency. This will be calculated by a C++ program, and so we will have faster and easier calculations to spend more time on the actual experimentation. The importance of the work that we are entering into is to create a more efficient way to harness the energy from the sun. This area is a little bit difficult, there are many people in the government's services that are working on the same kind of problems. There are many possible aspects that this project could impact. For one, the area which is the most obviously impacted is the industry of solar panels. The gratzel cell uses a more abundant energy source for the collecting of the sun's energy.

The problem that we are trying to solve is future power problems. This is important because many of the resources that we are using, such as coal, are very few and far between. The gratzel cell uses an abundant energy source which is not easily depleted: the sun's light. This is converted to energy by chlorophyll placed inside the gratzel cell. The scope of our work is mostly for places which are mostly sunny and have enough light to support a system of gratzel cells.

The way that we plan to go about doing finding this out, is to analyze the field data. This is so that we can use the program to just calculate because we do not have the kind of equipment that is needed to just design a program to find out what percentage that it will run at. The extent of our work is as many samples and electrolytes that we possibly can.

Gratzel Cells

Introduction

The Gratzel cell is a solar cell which contains any number of different substances to convert sunlight into electricity. The project that we did involves modeling the efficiency of the Gratzel cell which is determined by many different factors. The significance of this project is that if this technology can succeed, it may be a more efficient and more cost effective way of producing electricity. The other solar cells that have been in production are mostly composed of crystalline silicone.

Description

The way that this project was accomplished was by taking the efficiency rates of one of the team member's science fair projects and converting it into an algorithm. This was then put into a C++ code on the Manzano High School's ftp server/UNIX machine.

Results

The project was not completed in time to get any kind of formal results from the computer code or any other type of research that the team was doing. The team discovered that it is very hard to work in a group and found that most of the work was not planned out enough for the entire team to put a hand into and help out.

Conclusions

The results that we hoped for did not come for lack of willingness to work on the project faithfully. The team's most significant original achievement on this project was really not

extra special, but we did a little bit of coding to try to make the calculations quicker.

Recommendations

To effectively do this project in the amount of time allotted, we had to narrow the scope of study which we wanted to do. This was hard because all of the elements which we originally wanted to combine all had parts which we needed in the project for the equations and otherwise. Narrowing a project like this down to one thing does not make it any easier.

As a group, we were also hard pressed to get the equations and decide what we wanted in the C++ code so it is a very primitive form of this program.

We also had problems in getting the entire group to understand and process this project. A larger group is harder to work with than a smaller one. These problems were greatly due to the lack of interest of some of the members of the group.

We also plan to keep working on the coding for this project for the next few weeks and modify the code to take in mind the ways to compute efficiency for different types of gratzel cells.

Acknowledgements

Team 41 would like to first acknowledge our teacher, Mr. Steve Schum for letting us participate in this class and for being very helpful and informed about C++ computer code.

We would also like to acknowledge Mr. Patrick Matthews, Mr. Schum's student teacher, for helping to keep us on task in the classroom.

The last person we would like to acknowledge is Mr. Steve McAllister for helping us to organize the code and help us come to the correct conclusions for our equations.

Bibliography

http://www.solaronix.com/technology/technology.html

http://www.its.caltech.edu/~mmrc/nsl/tio2.htm

http://dcwww.epfl.ch/icp/ICP-2/solarcellE.html

http://news.bbc.co.uk/1/hi/sci/tech/2000633.stm

http://scipp.ucsc.edu/program/ret/99/Larryetp.html

http://www.bath.ac.uk/physics/news/pastnews.html

http://www.electronicstimes.com/tech/news/OEG20020529S0023

http://www.solideas.com/solrcell/cellkit.html

http://dcwww.epfl.ch/icp/ICP-2/sfcellfr.html (**French**)

http://dcwww.epfl.ch/icp/ICP-2/electr.html

http://dcwww.epfl.ch/icp/ICP-2/icp-2.html

http://jchemed.chem.wisc.edu/Journal/Issues/1998/Jun/abs752.html

http://www.konarkatech.com/

http://www.acs.comcen.com.au/TiO2solar.html

http://www.eere.energy.gov/RE/solar_photovoltaics.html

http://www.pv.bnl.gov/abs_157.htm

http://www.ecn.nl/library/reports/1998e/rx98040.html

http://www.ecn.nl/library/reports/2000e/rx00015.html

http://www.esqsec.unibe.ch/ecos98.htm

http://jchemed.chem.wisc.edu/Journal/Issues/1998/Jun/abs752.html

Appendices

Sample Code

```
//Stephanie McAllister    filename: scode.cc
/*Sample code for AiSC team#41

    This sample code will compute the value for given equations which were
introduced earlier.  */

#include <iostream.h>
#include <math.h>
#include <stdlib.h>

int main()
{
 int choice;
 float l, c, y;
   cout<<"This program computes the value for l/c=y"<<endl;
   cout<<"\nTo continue this program enter 1; to exit, enter 3."<<endl;
   cin>>choice;

  if(choice==1)
   {
    cout<<"Please enter a positive value for total light"<<endl;
    cin>>l;
    cout<<"Please enter a positive value for how much light is "
          "\n\tbeing converted into electricity"<<endl;
    cin>>c;

    y=l/c;

    cout<<"The efficiency = "<<y<<endl;
    }

   else
   {
    cout<<"Have a nice day!"<<endl;
   }

 return 0;
}
```