Research paper on Alternative solar cell and its Application

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***Abstract*— Alternative solar cell can have practical application for renewable energy production. This paper is mainly concentrated on production of low cost electrolytic cuprous oxide solar cell which can serve as an alternate to solid state solar panel. A brief study of the performance of existing solar cell silicon was experimented first, before designing an electrolytic cuprous oxide solar cell. Our electrolytic solar cell consisting of cuprous oxide electrode with copper electrode in aqueous sodium chloride as an electrolyte produced a potential difference up to 0.50 volt at 50 ampere. Various factors such as amount of light intensity, electrolyte concentration, total surface area of electrode and distance between the two electrodes were measured and calibrated and results were noted.**

***Index Terms*—Solar cell, electrolytic cuprous, Cuprous oxide cell.**

I. INTRODUCTION

The solar cell made up of silicon has high price which is not affordable for small scale application purpose, hence alternative to it as a cuprous oxide cell with NACL as an electrolyte has been studied for this purpose due to low toxicity , low cost, easily availability.

II. METHODOLOGY:

The following section willhighlight our experimental procedure based on several parameters.

1) Design goal:

The main goal of our setup was

- Designing cuprous oxide solar cells that uses materials which is easily available abundantly in nature.
- Designing cuprous oxide solar cells that would set aside the need for high priced semiconductor materials.

2) Design iteration:

Based on this design objective we designed aqueous sodium chloride based copper-cuprous oxide solar cell.

3) Final design:

After going through all of these design iteration and initial design testing described above, the final design for our setup was finally determined:

- Electrolyte – Aqueous sodium chloride (NACL) for varying concentration.

- First electrode – copper plate coated with cuprous oxide layer.
- Second electrode-copper plate
- Cavity material – glass, plastic.

III. EXPIERMENTAL DETAILS

Materials:

- Two copper plate.
- .Micro-ammeter
- Galvanometer.
- Electric hot plate
- Shallow glass, plastic beaker.
- Two alligator clip leads
- Gloves
- NACL

4.1) the first step is to cut a copper sheet and a piece of the copper sheet that is about the size of the burner on the stove .wash your hand so, they don't have any oily layer on them. Then wash the copper sheet with oil remover to remove oiliness of copper on it and also light corrosion is removed. Next keep the cleaned and dried copper sheet on the burner and turn the burner to its highest position.

Fig (4.1)
Source: scitoys.com

4.2) As heating of copper starts, you will see pleasing oxidation patterns begin to form red orange, purplecolour will cover the copper.

Fig (4.2)
Source: scitoys.com

4.3) As the temperature of copper increases, copper gets hotter, the orange, purple and red colour are replaced with cupric oxide of black oxide.

Oxide that we want is not this but it will stratum off later, showing the purples reds, oranges, and pink colour of the cuprous oxide layer beneath.

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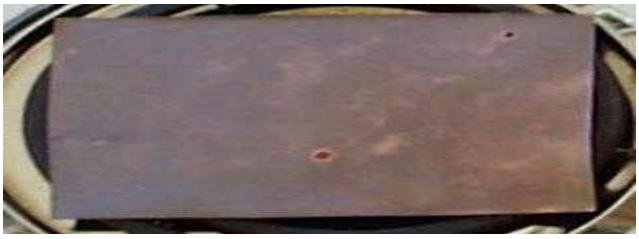

Fig (4.3)
Source: scitoys.com

4.4).The last bits of colour disappears as the burner starts glowing red.

Fig (4.4)
Source: scitoys.com

4.5)the sheet of copper will be coated with a black cupric oxide coat layer when the burner is glowing red-hot.
keep it for a 45 minutesor an hour so the black coating will be thick,this is important since a thick coating will stratum off nicely, when a thin coat will stay stuck to the copper .

Fig (4.5)
Source: scitoys.com

4.6)turn off the burner; after the half an hour of process.leave the hot copper on the burner to cool slowly.The black oxide will stay struck to the copper. If you cool it too quickly, the black oxide will stay struck to the copper

Fig (4.6)
Source: scitoys.com

4.7) as the copper cools, it shrinks the black cupric oxide also shrinks. But they shrink at different rates, which make the black cupric oxide stratum off.

Fig (4.7)
Source: scitoys.com

4.8) The little black flakes pop off the copper with enough force to make them fly a few inches.

Fig (4.8)
Source: scitoys.com

4.9) When the copper has cooled to room temperature this takes about 30minutes most of the black oxide will be gone a light scrubbing with yours hand under running water will remove most of the small bits. Resist hard scrubbing by flexing the soft copper this might damage the delicate red cuprous oxide layer we need to make to solar cell work.
The rest of the assembly is very simple and quick.
Cut another size of copper plate about the same size as the first one .bend both pieces gently so they will fix into the glass jar without touching one another. The cuprous oxide coating that was facing up on the burner is usually the best side to face outwards in the jar because it has the smoothest, cleaned surface.
Attach the two alligator's clips leads, one to the new copper plate and one to the cuprous oxide coated plate. Connect the lead from the clean copper plate to the positive terminal of the meters.
Now mix a couple table spoon of salt into some hot tap water .stir the salt water until all the salt is dissolved. then carefully pour the salt water into the jar , being carefully not to get the clip lead wet .the salt water should leave about an inch of plate above the water ,so you can move the solar cell around the without getting the clip lead wet.

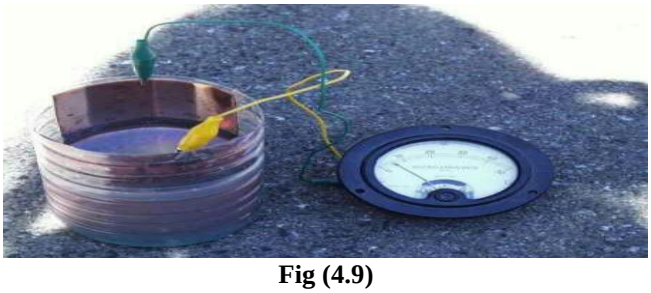

Fig (4.9)
Source: scitoys.com

The photo above shows that the solar cell in my shadow as I took the picture. Notice that the meter is reading about 6 micro amps of current
The solar cell is battery, even in the dark, and will usually shows a few micro amps of the current
4.10) The photo shows that solar cell in the sunshine .notice that meter has jumped up to about 38 micro amps of current; sometime it will go over 50 micro amps, swinging the needle all the way over to the right.

Fig (4.10)
Source: scitoys.com

IV. WORKING:

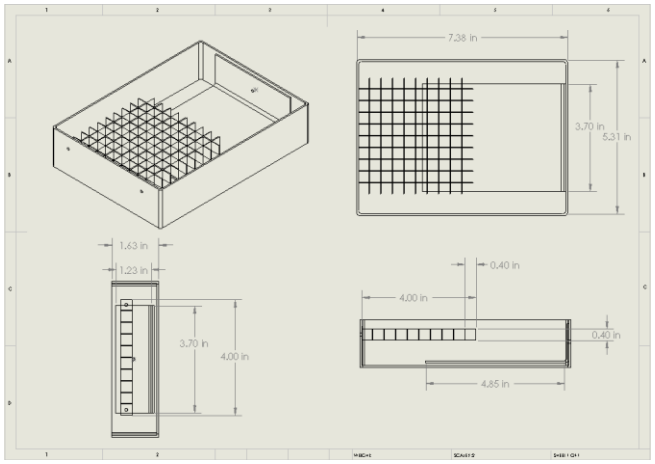

Fig 5.1 - Mechanical Diagram
Source: project doc by Mairaj Aftab Malik
(Alternative solar cell and its implications)

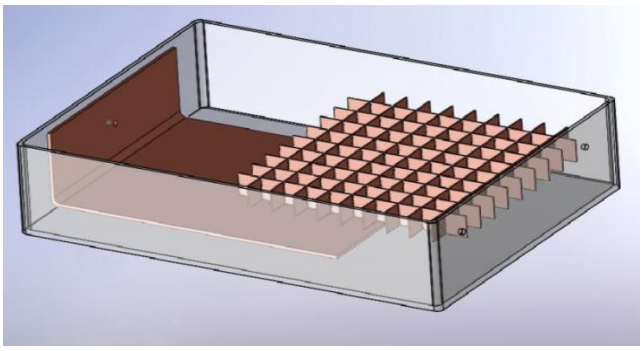

Fig (5.2) cad model of solar cell
Source: project doc by Mairaj Aftab Malik
(Alternative solar cell and its implications)

Cuprous oxide is a type of material called as a semiconductor. A semiconductor is in between a conductor where electricity flow freely, and an insulator, where electrons are bound tightly to their atoms and do not flow freely.in semiconductor, there is a gap called a band gap between the electrons that are bound tightly to the atoms and the electrons that are farther from the atom, which can move freely and conduct electricity. Electrons cannot stay inside the band gap electrons cannot gain enough energy to move farther away from the nucleus, outside of the band gap.an electrons must gain enough energy to move farther away from the nucleus, outside of the band gap. Similarly, electrons outside the band gap cannot lose a little bit of energy and fall just a little bit closer to the nucleus.it must lose enough energy to fall past the band gap into the area where electrons are allowed.
When sunlight hits the electrons in the cuprous oxide, some of the electrons gain enough energy from the sunlight to jump past the band gap and become free to conduct electricity the free electrons move into the saltwater, then into the clean copper plate into the wire through the meter and back to the cuprous oxide plate As electrons move through the meter, they perform the work needed to move the needle. When a shadow falls on the solar cell, fewer electrons move through meter and the needle dips down.

V. RESULT:

The cell produces 50 micro amps at 0.50volt..it can be used as a light detector or light meter but it would take acres of them to power our house.
For the 0.00000125watts(12.5microwatts) a 0.02 square meter cell, or 1.38mill watts per square meter .to light a 100 watts light bulb ,it would take 93,000 square meter of copper for the dark electrode to run a 1200 watt store you would need 9,00,000 square meter of cuprous oxide and another 8,00,000 square meter of plain copper or 1,500,000 square meter all together. If this were to form the roof of a home each home would be 282 meter long and 385 meter wide, assuming that they need electricity For one stove.

Fig (6.1) – Digital display unit
Source: project doc by Mairaj Aftab Malik
(Alternative solar cell and its implications)

VI. DISCUSSION ON APPLICATION:

The copper is very easily and abundantly available in nature. This can have practical application for renewable energy production.
One major place where our copper cuprous oxide solar cell can be implanted is in the large salt body of the earth. Earth surface has nearly 61%salt water in the form of ocean.so all the water bodies are potential solar cells because if we immerse copper and cuprous oxide solar electrode in them and because of photovolatics effect as described in my research paper we are able to harness a large amount of solar energy and convert it into electrical energy

Thus many electrical systems can be done on ship and boats for production of electrical energy such as:

1. In case small boat travelling in salt water body , it is impossible to travel by boat in night due to lack of light on boat this scarcity of light problem can be solved by plating boat with copper-cuprous oxide layer with salt water(NACL) as an electrolyte and producing solar cell which will generate electrical energy by photovolatics process while travelling in sun light and can be stored in battery for using it at night.
2. In case of ocean and sea security the security forces can generate electricity by just immersing copper –cuprous oxide electrode into the sea water (NACL) as an electrolyte and they will readily get the electrical energy which can be used for metal detector and various other DC supply electrical security instruments for recharging purposes.
3. It is impossible to charge mobile batteries while travelling on boat by AC source. This can be tackled by using cuprous oxide solar cell with salt water(NACL) as an electrolyte, by converting DC source to AC By applying dc to ac convertors while travelling on boat.
4. Charging of pocket calculators can be easily possible by copper-cuprous oxide solar cell with NACL as an electrolyte in space also
5. Electrotherapy requires micro ampere current where copper-cuprous oxide solar cell with NACL as an electrolyte has wide applications
6. Micro current electrical neuron muscular stimulator can be charged or recharged by using copper-cuprous oxide solar cell with NACL as an electrolyte
7. For cosmetic therapy of skin small electrical volt is required which can be supplied by copper-cuprous oxide solar cell with NACL as an electrolyte
8. For acupuncture therapy small electrical volt is required which can be supplied by copper-cuprous oxide solar cell with NACL as an electrolyte

VII. ADVANTAGES:

- Low cost to produce.
- Great availability.
- It produces 50 micro amp current at 0.25 volt.
- Non toxicity
- Cuprous oxide is very attractive as photovoltaic material because of its high absorption coefficient in visible region

VIII. LIMITATIONS:

- Trained and Skilled workers are required.

IX. CONCLUSION:

The main aim of this research was to lower the price /watt of solar power by proposing alternate solar cells made of cheap materials. Based on our research we have proposed a model for a new solar cells.it consist of pn junction made of copper and copper oxide along with ionic salt water (NACL) solution.

X. REFERENCES:

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[4]Research article on "Electro deposition of cuprous oxide for thin film solar cell application" by Seyed Mohammad Shahrestani.

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Research work:
1] Research on improving techniques of artificial snow formation by artificial snow equipment's.
2] Research on improving efficiency of copper-cuprous oxide solar cell in NACL Electrolyte.
3] Research on solar metal detector.
4] Research on advanced trends in automation of artificial snow equipment.
5] Research on energy management of hybrid solar-windmill power plant.
6] Research on advance trends in refrigeration system design.
7] Research on vibration acoustics.
8] Research on advanced sensor technology.
Seminar: Presented seminar on "Vibration Acoustics" in D.Y.Patil technical campus Talsande, Kolhapur, Maharashtra, India.
Extra-curricular Activities
1] Completed Auto cad course.
2] Participated in National level technical event INFINITY 2015 at D.Y.Patil College of engineering and technology, Kolhapur
3] Participated in National level technical event Techvaganza 2k15 at Dr.J.J.Magdum college of Engineering, jaysingpur
4] Participated in National level technical symposium in association with ISTE, Delhi at Ashokrao Mane Group of institutions, Kolhapur