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The Application of Carbon Nano Tubes-The Paper Battery

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Abstract: ***The paper battery is becoming increasing significant as technology tends towards thinner and more paper like devices. The battery will currently provide a low, steady power output, as well as a super capacitor's quick burst of energy. With the ever increasing demand for efficiency and design, there is a need for ultra thin, safe and flexible energy storage options. A paper battery is a flexible, ultra- thin energy storage and production device formed by combining carbon nano tubes with a conventional sheet of cellulose based paper. A paper battery acts as both a high energy battery and super capacitor, combining two components that are separate in traditional electronics. Carbon Nano Tubes is main concept behind the paper battery which is allotropes of carbon with a cylindrical Nano structure, the flexibility can function even if it is rolled up folded or cut .The aim of this topic at the understanding and analyzing, the construction properties advantage, the applications and future scopes and also highlights the limitations, needed and disadvantage***
Keywords: Super capacitor, Carbon Nano Tubes, Allotropes and Pace maker.

I. INTRODUCTION

A paper battery is a flexible, ultra- thin energy storage and production device formed by combining carbon nanotubes with a conventional sheet of cellulose based paper. A paper battery acts as both a high energy battery and super capacitor, combining two components that are separate in traditional electronics. This combination allows the battery to provide long term, steady power production and bursts of energy.

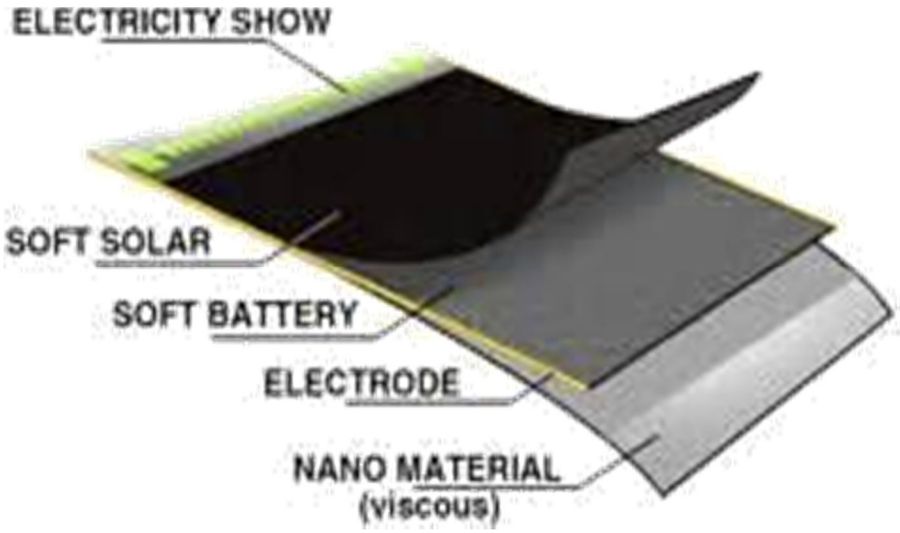


Fig 1: component of paper battery.

Through the use of super capacitors, batteries can be made that will deliver renewable energy from bodily fluids such as blood or sweat. This technology can be greatly utilized by medical devices. It combines two essential materials, cellulose and carbon nanotubes (CNTs), that fit the characteristics of spacer and electrode and provide inherent flexibility as well as porosity to the system. Cellulose, the main constituent of paper and an inexpensive insulating separator structure with excellent biocompatibility, can be made with adjustable porosity. CNTs, a structure with extreme flexibility, have already been widely used as electrodes in electrochemical structure devices. CNTs are allotropes of Carbon Nano structure, Nano Tubes is the member of fullerene family. The name is derived from their long hallow structure with the form by one atom thick sheet of carbon.

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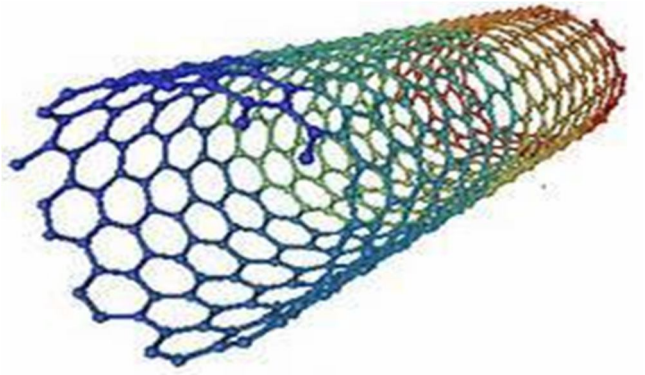


Fig 2: Structure of carbon Nano Tubes.

II. APPLICATIONS

With the developing technologies and reducing cost of CNTs, the paper batteries will find applications in the following fields-

A. Electronics

1) in laptop batteries, mobile phones, handheld digital cameras:
2) in calculators, wrist watch and other low drain devices
3) in wireless communication
4) in Enhanced Printed Circuit Board(PCB)

B. Medical Sciences

1) in Pacemakers for the heart
2) in Artificial tissues (using Carbon nanotubes)
3) in Cosmetics, Drug-delivery systems
4) in Biosensors, such as Glucose meters, Sugar meters, etc.

C. Automobiles and Aircrafts

1) in Long Air Flights reducing Refueling
2) for• in Hybrid Car batteries
3) Light weight guided missilile

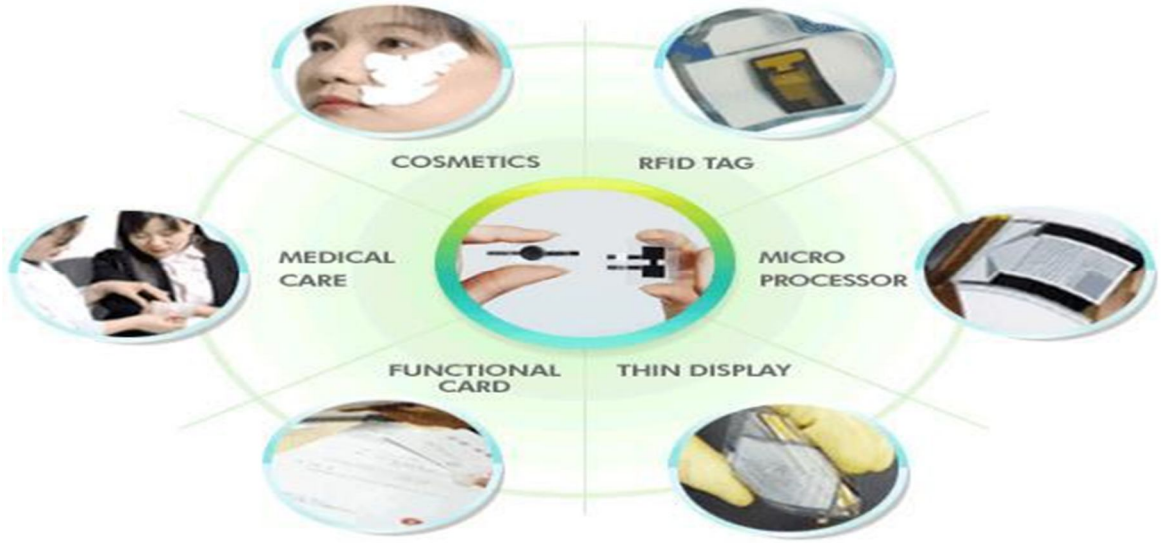


Fig:3-Applications of paper battery.

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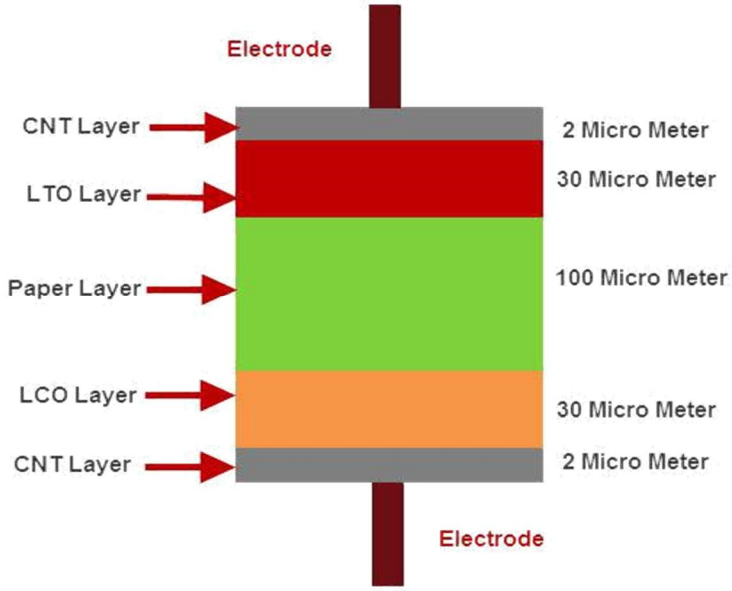
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a) *Needs and Limitations of paper batteries Needs Limited Life Time:* Primary batteries 'irreversibly' transform chemical energy to electrical energy. Secondary batteries can be recharged but they have very short life time, paper batteries overcome both problems.
b) *Leakage:* In case of leakage the chemicals release may be dangerous but no such toxic chemicals are used in paper batteries.

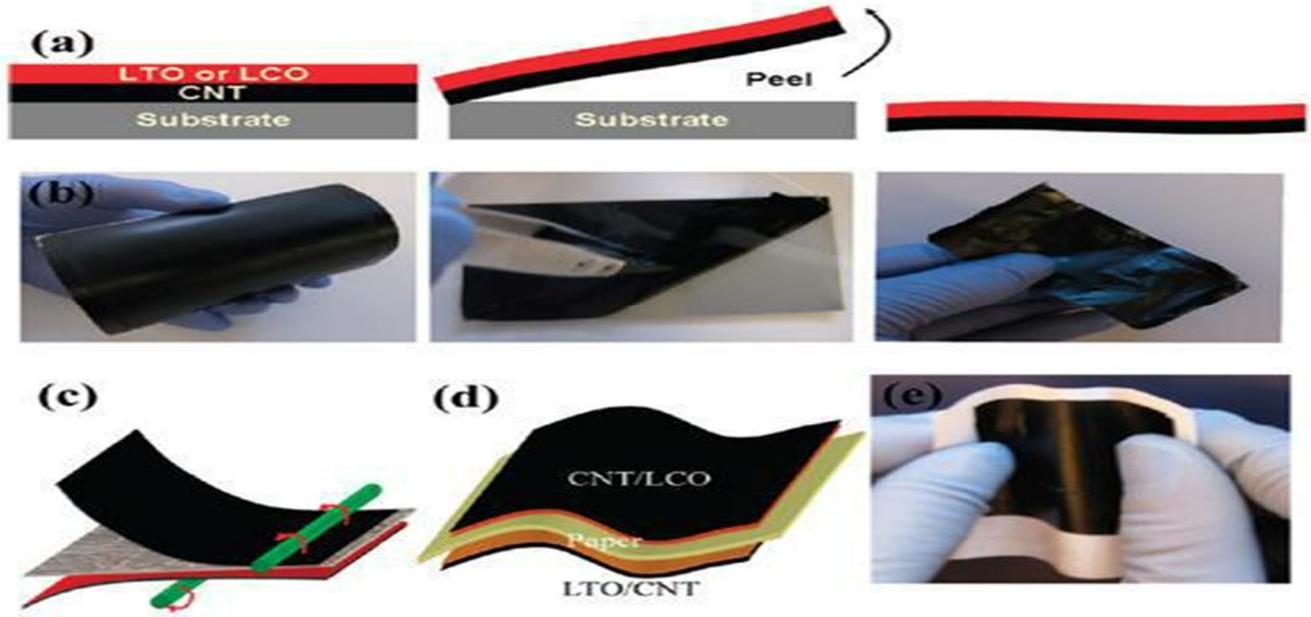
D. Environmental Concerns

The wide spread use of batteries has created many environmental concerns, such as toxic metal pollution etc. while paper batteries can be easily decomposes without any harm.

E. Structure of Paper Battery



F. Paper Battery Construction



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G. Future Scope :-

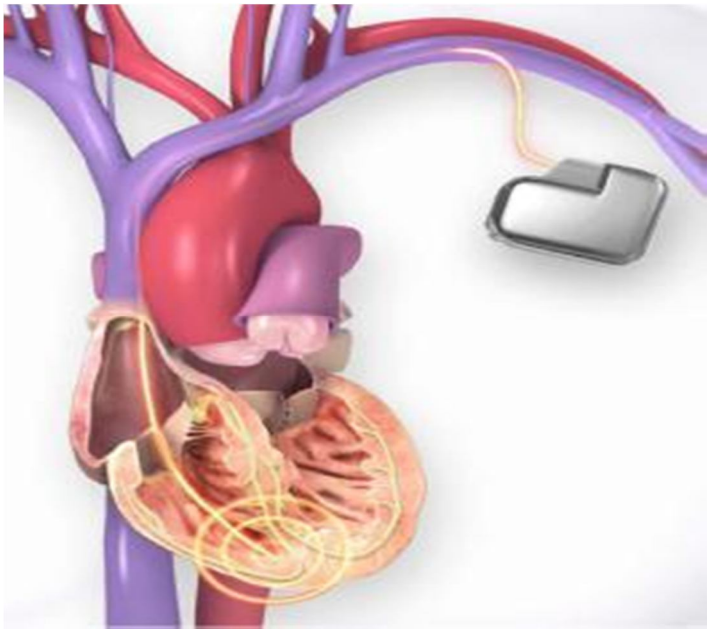
The paper like qualities of the material make it especially attractive for energy storage in medically implanted devices (for example, a pacemaker, insulin pump or the implantable radio chip).

H. Why would I need one?

1) Your heart beats too slow or too fast.
2) Your heart doesn't beat regularly.
3) There's a block in your heart's electrical pathways.

I. How does it work?

1) A pacemaker uses batteries to send electric signals to your heart to help it pump the right way.
2) The pacemaker is connected to your heart by one or more wires. Tiny electric charges that you can't feel move through the wire to your heart.
3) Pacemakers work only when needed. They go on when your heartbeat is too slow, too fast or irregular.



J. Advantages

1) Used as both battery and capacitor.
2) It is ultra thin energy storage device.
3) Steady power production.
4) Shaped for different applications.
5) High efficiency.
6) Available in different sizes.
7) Energy efficient.
8) It is light weight.
9) It is more economical.
10) Can be easily dispose Can be recharged.
11) Generates close to 1.5 Volts of energy.

K. Disadvantages

1) Prone to tearing.
2) Nano tubes made from carbon are expensive due to use of procedures like electrolysis and laser ablation.
3) Should not be inhaled, as they can damage lungs.

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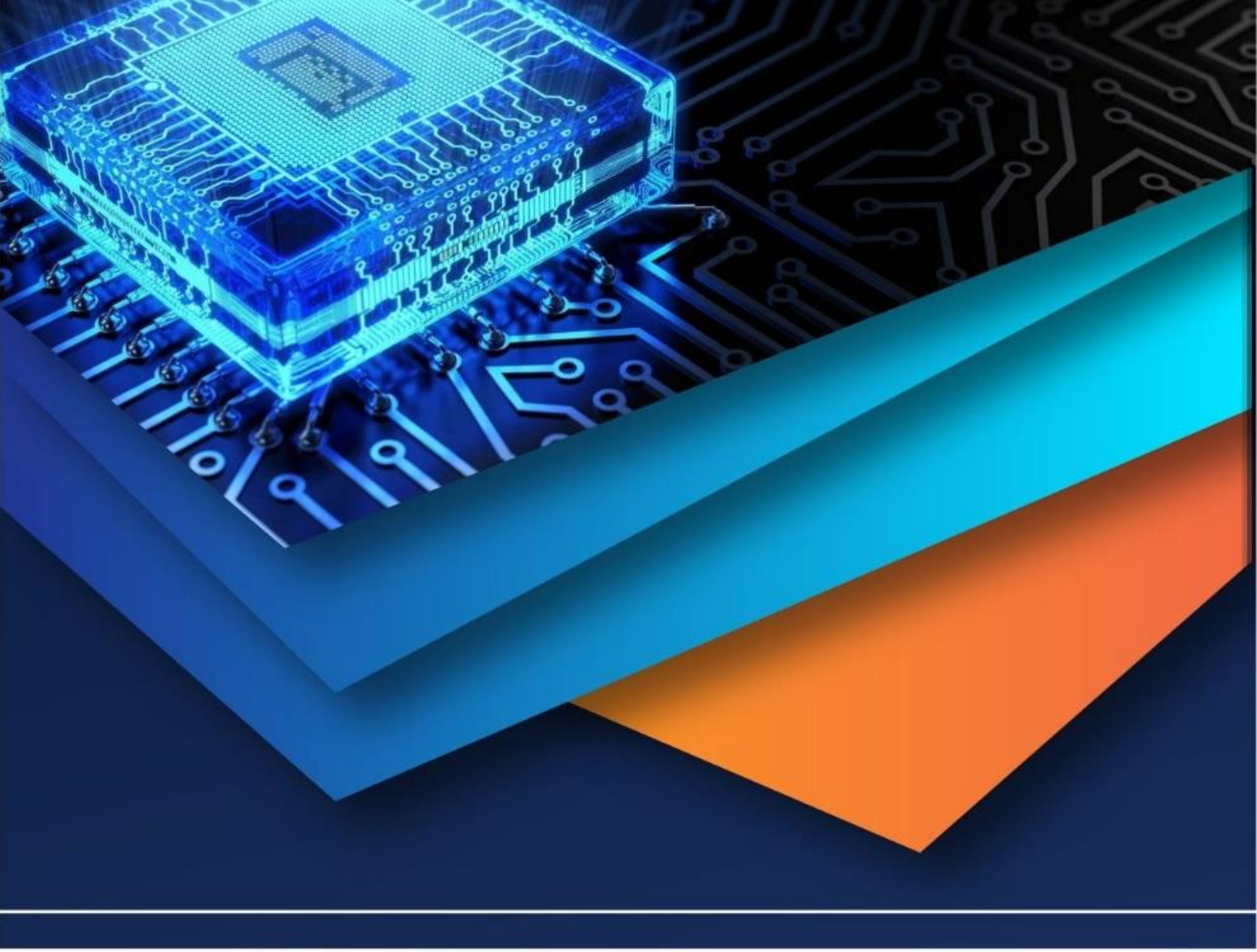
III. CONCLUSION

A paper battery is a paper like device formed by the combination of carbon Nano Tubes and a conventional sheet of cellulose-based paper which act as a flexible ultra-thin energy storage and energy production device. In addition to using the aqueous and RTIL (Room Temperature Ionic liquids) electrolytes, the device operates with a suite of electrolytes based on bodily fluids. It suggests the possibility of the device being useful as a dry-body implant or for use under special circumstances.

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