Inbuilt Charging Technique for Mobile Phones Using Nano Technology

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Abstract--- Recent survey of the electricity board of AndhraPradesh says that the: "Energy Consumed In A Month By All Mobile Phones In Andhra Pradesh For Charging Up Is Equivalent To That Required By A Cotton Mill To Be Driven For A Year". To counter this problem we have come up with an innovative idea to charge up the cell phone by means of nanoscale mechanical and thermal energy. A novel approach converts nanoscale mechanical and thermal energy into electric energy for self-powering nanodevices. In our own work, we've used piezoelectric zinc-oxide nanowire (ZnO NW) arrays and thermoelectric nanowires of nanoporous silicon cages to demonstrate a novel approach for converting nanoscale vibrations, room and body temperature into electric energy, which in turn could be used to charge the mobile phone. Using **piezoelectric** material, we could create nanowires that generate electricity from the **vibrations suffered by the cell phone**. The piezoelectric effect is a phenomenon certain materials exhibit in which when a physical force applied to a piezoelectric material, it emits an electric charge and vice versa. Piezoelectric nanowires might provide power to nano-size systems in the future. Thermoelectric devices can convert heat into electricity. Various researchers are working to produce inexpensive and efficient thermoelectric materials that can change waste heat into electricity. Recently there was an announcement that researchers at Berkeley had made silicon nanowires that convert heat into electricity using a thermoelectric effect. One possible use of these is to charge portable devices. The wires could be simply be knit as the panel of cell phone and thus the panel could become a charging station. Using the body temperature and room temperature as the source of energy, it could generate the electricity.

I. INTRODUCTION

A. Nano Piezo Electricity

When piezo electric materials are drawn into nano wires (NWs) called PIEZO NANO WIRES, they can efficiently develop a greater potential difference as compared to the bulk state. Even a small mechanical disturbance can cause a greater potential difference. Here we present simple, low-cost piezoelectric zinc oxide nanowires grown radially around textile fibers.

A thermoelectric material converts a temperature difference across a material into a voltage and silicon's low thermal conductivity at nano scale means that a meager amount of heat is required to create a large potential difference, making it a very efficient thermoelectric material.

University of California Berkeley created arrays of tiny silicon nanowires by dipping silicon wafers into an aqueous solution of silver ions. The nanowires were 20 to 300 nm in diameter and the team discovered that arrays have a thermoelectric efficiency about 60-times greater than bulk silicon at room temperature. This rise in efficiency occurs because heat-carrying sound waves called phonons have a very difficult time moving along the very narrow nanowires, reducing their ability to conduct heat. One important feature of thermoelectric nanowires is that their surfaces are rough, which contributes to their high thermoelectric nature. Now that we have an efficient thermoelectric nanowire, we can convert room temperature and body temperature to electricity

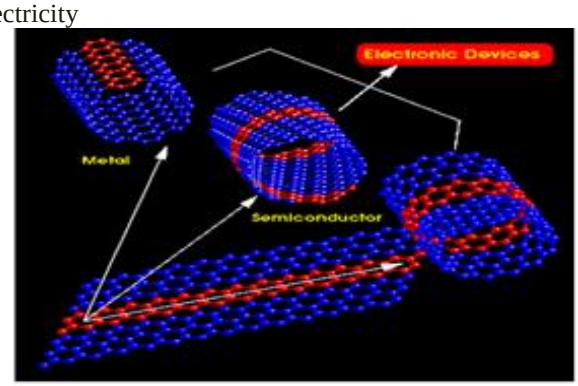

Fig. 1: Thermo electric material

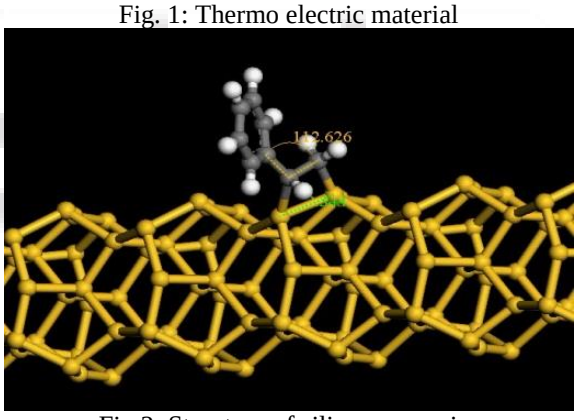

Fig 2: Structure of silicon nanowire

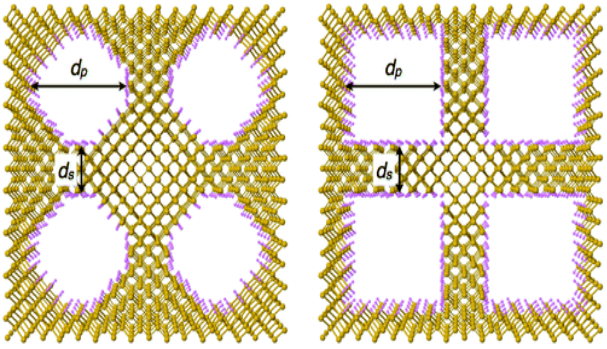

Fig 3: Structure of nanoporous silicon cages.

B. Nano Piezo Generator For Cell Phones Construction:

Our innovative idea is to create a nano generator (NANOGEN) for cell phones, efficient enough to supply power to the battery whenever the phone vibrates and by converting the room temperature to electricity, thereby extending the hold of charge in it.

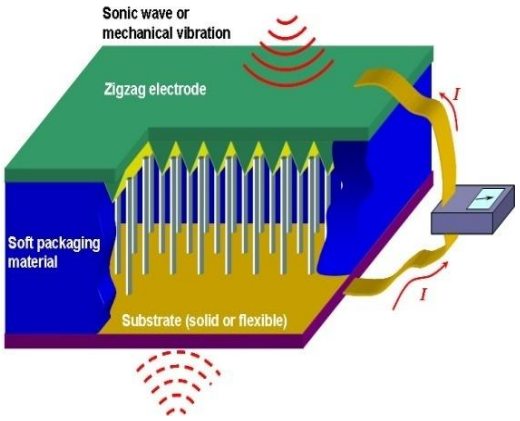

Fig 4: Nano Piezo generator for cell phones

It consists of two plates made of NANO GOLD, sandwiching a bunch of nano wires of ZINC OXIDE. Two leads arise from the either plates and constitute the output electrodes from which the electric energy is obtained.

$$n * d \approx A$$

Where "n" is the number of nano wires of diameter "d" constituted in the given area "A" of nano gold plates.

Since the diameter of nanowires range from 50 nm to 100 nm, the number of wires in the nano generator of dimension 1 cm X 1 cm ranges from 1000 to 2000. This setup when subjected to a deformation of 10° gives rise to a potential difference of 3v to 6v.

C. Working Principle Of Nano Piezo Generator:

The nanogen works based on the principle of piezo electricity. But the only difference is that it works at nano scale. The nano generator so produced will be of 4 mm thick to the maximum. So it will be comfortable to accommodate the nanogen within the cell phone. Whenever the cell phone vibrates, the nanogen will be put to mechanical distortion at a constant and low frequency. The nanogen being sensitive even for low frequencies and lower degrees of distortion, it generates a potential difference by the concept of piezo electricity. The nano gold plates assist in collecting current from those nano wires. Gold behaves as an excellent conductor with negligible resistance at nano scale. Hence the output of the nanogen in response to the mechanical vibration will be a potential difference of the order of 3 to 6 volt.

This potential difference is of DC type and hence can be directly used for charging up the battery of the mobile phone.

D. Nano Thermo Generator For Cell Phones:

Bulk silicon is a poor thermoelectric material at room temperature, but by substantially reducing the thermal conductivity of our silicon nanowires without significantly reducing electrical conductivity, we have obtained ZT values of 0.60 at room temperatures in wires that were approximately 50 nanometers in diameter. By reducing the diameter of the wires in combination with optimized doping and roughness control, we should be able to obtain ZT values of 1.0 or higher at room temperature. We've shown that it's possible to achieve a large enhancement of thermoelectric energy efficiency at room temperature in rough silicon nanowires that have been processed by wafer-scale electrochemical synthesis.

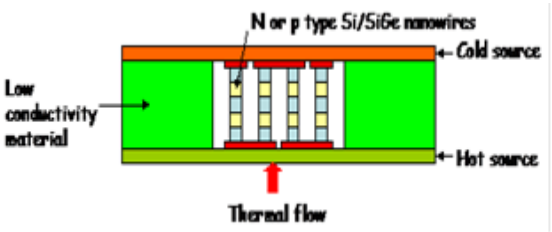

Fig 5: One of the types of Nano Thermo generator

Now if these thermoelectric nanowires of silicon could be knit or if it could be fabricated in the form of a nanofilm, we could possibly make the cell phone panel out of it.

Now that the cell phone panel is made out of the thermoelectric nanomaterials, it can absorb the atmospheric temperature and convert it to electricity and thereby supply charge to the cell phone by means of two external leads which are at bulk state only. Then the panel will do the work of converting the room and body temperature to electricity.

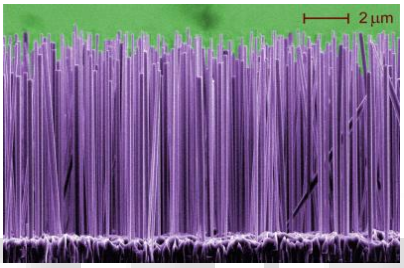

Fig. 6 : Silicon nanowires

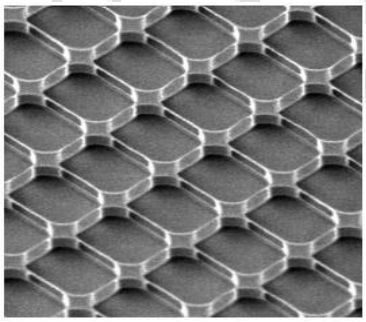

Fig 7 : Nanoscale image of the silicon nanowires knit up to form the casing of cell phones.

Thus we see that the thermo nano generator can take any shape viz knit up nanowires, nanoporous silicon films, and even an arrangement similar to the piezo nanogenerator wherein there are two plates maintained at different temperatures and the thermoelectric nanowires sandwiched between them.

II. The Voltage Handling And Regulation Unit:

Normally a cell phone requires 3.7v for getting charged up. Both the nanogenerators (piezo and nano) cannot constantly supply 3.7v. Though it would not go below the mark of 3.7v, there are sure possibilities of exceeding this limit when the atmospheric temperature rises or when the amplitude of vibrations are more.

This demands another unit that will regulate the voltage and maintain it at the constant level of 3.7 volts.

This unit must be designed such that it neither adds to the cost nor to the size of the cell phone.

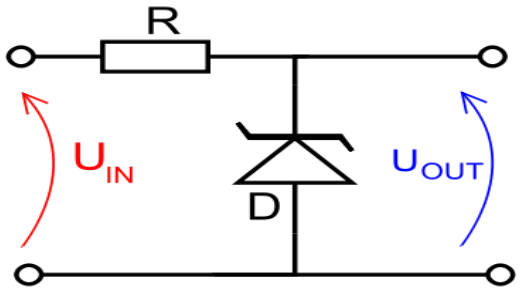

Fig 8 : Zener voltage regulator

Zener diode is an efficient voltage regulator which could regulate the incoming voltage and give a constant output of 3.7v.

We go for zener diode regulator unit because under exceptional conditions such as very high temperatures and very high amplitude vibrations also, the nano generators are demanded to deliver constant power. Under such conditions the output of the nano generators will be much larger than the required one. Hence we are in need of incorporating the regulation unit. The data sheet of zener diode gives us the ranges of operation that enables us to easily implant it at the cascaded end of two nanogenerators.

III. CONCLUSION:

This Concept Of Nano Piezo Generator And Nano Thermo Generator, Using Nano Wires Will Go A Long Way In Eliminating Adapters To Charge Cell Phones. Moreover Energy Loss In A Cell Phone Can Be Used To Charge The Battery And Thereby Prolonging The Stand Of Charge In Cell Phone.

The Tensile Strength Of The Nanoporous Silicon Nanowires Will Provide A Strong Casing For The Cell Phones. The Nano Generator Adds Neither To The Weight Of The Cell Phone Nor To The Cost. Thus Wireles Mobile Charging Using Nanotech Would Be A Niche In The History Of Mobile Technology.