# GRAPHENE – THE NEW UPCOMING TREND IN TECHNOLOGICAL WAVE

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**Abstract**– With the aim of achieving technological advances, our work focuses on the development and applications of low resistance carbon nanotube called GRAPHENE. It is one atom thick material with outstanding properties that make it an excellent candidate for advance application in future electronics. Being thinnest, flexible and unbreakable across the world, this wonder material is all set to revolutionize the smartphones and the tablet industries by replacing current touchscreen technology and enhancing their battery life. Its amazing properties as the lightest and the strongest material compared with its ability to conduct heat and electricity better than anything else, it can be integrated into a huge number of applications i.e in designing processors, databases and in 3D printing. It has very good sensing ability by which it has wide spread applications in bio medical fields like detection of cancer , HIV and in telecommunication by sensing signals. This paper describes the progress of this technology from the moment of its discovery to its future scope.

**Keywords**- Technology, Work Focuses, Flexible, Unbreakable.

## I. INTRODUCTION

As 20th century was the age of plastics, 21st century will be the age of graphene, a recently discovered material obtained from honeycomb sheets of graphite. It was first discovered by Andrie Geim and Konstantin Novoselov in 2004 at Manchester City. It is the basic structure element of other allotropes including charcoal, graphite, carbon nanotubes and fluerance. It is the strongest, thinnest material known to exist. The first time graphene was artificially produced. Scientist literally took a piece of graphite and dissected it layer by layer until only single layer remain. It is chemically the most reactive form of carbon. It burns at very low temperature, that is, 350 C. It was found that graphene is harder than diamond and about 100 times harder than steel. Its thermal conductivity is much higher than all the other carbon structures.

The material's high mobility and high thermal conductivity could lead to chips that are not only faster but also better at dissipating heat. Due to its unique electronic properties, it absorbs a high 2.3 % of light that passes through it. Graphene could soon be used to analyse DNA at a record breaking pace. Its high carrier mobility as well as low noise allows it to be used as a channel in a field-effect transistor.

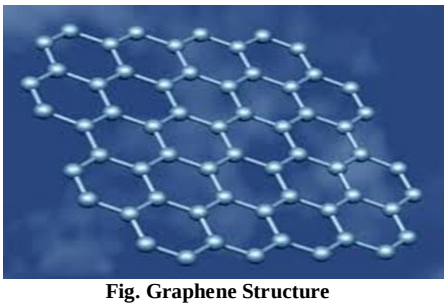

**Fig. Graphene Structure**

Graphene's high electrical conductivity and high optical transparency make it a candidate for transparency conducting electrodes. Its mechanical strength and flexibility are advantageous compared to indium tin oxide which is brittle, so it would work very well in optoelectronic applications such as liquid crystal display, organic photovoltaic cell , touch screen and organic light emitting diodes. Graphene's mechanical and electronic properties will find applications into making a new generation of super strong composite material and along combine with its optical properties, making flexible and imperishable displays.

## II. GRAPHENE IMPLEMENTATION IN CELLULAR PHONES

The majority of touch screens in the present market, made up of silicon and indium tin oxide films use a traditional technology called "Analog Resistive". When an individual squeeze the screen, it makes contact with the glass layer, completes a circuit and hence it registers the user input. The top and bottom layers are both encompassed with a grid of an electrical conductor.

As stated in "current screen issues," almost a quarter of all iPhone users have experienced an issue with cracked screens [9]. This is an extremely alarming rate that needs to be fixed. This is where graphene comes into the picture. Since graphene is stronger, more flexible, and transcends the conducting ability of both these materials, it is used in the creation of "bendy phones". But in this method we will be replacing the glass layer with the one atom thick graphene sheets. Instead of using indium tin oxide we can use the carbon nanotubes which are made up of graphene so that we can integrate everything on a single smaller chip. So the upcoming cell phones will become thinner.


**Fig. Unbreakable and foldable smartphones**

Due to its high carrier mobility and thermal conductivity, smartphones will get charged in 20 seconds and will run all the day. These flexible screens could improve watching videos and playing games among other positives. One other riveting capability of flexible phones is the ability to vastly improve audio quality in cell phones. By converting the phone into an arc, the speakers are able to resonate off the other sides of the phone, deepen the sound. Therefore, the decibel level produced by the speakers is greatly increased without any costly additions of improvements being made.

## III. GRAPHENE-PROCESSOR TECHNOLOGY OF THE FUTURE

As various types of semiconductors like silicon and germanium are used to design electronic devices due to their temperature tolerance characteristic. The newly developed material Graphene has its high thermal conductivity, which when used in place of silicon and germanium can speed up processor to high frequency rate. The writing is on the wall for the silicon chip. Transistors have been diminishing for the last half a century but they cannot get smaller forever. Most industry corporate thinks that the downscaling of silicon chip technology cannot extend much beyond 2026. The immense question, of course, is what will replace it. One prospect is graphene, which various teams around the world have used to make hugely fast transistors. In 2010, one team clocked a graphene transistor at around 427 GHz. So one could be forgiven for considering that graphene is the perfect silicon replacement.

Engineers at IBM Research on Apr 7, 2011 have built the world's most facilitating graphene-based chip, with properties that are 10,000 times better than previous graphene ICs. The key to the infiltrate is a new industrialized technique that allows the graphene to be deposited on the chip without it being damaged (something that has heretofore been very hard to achieve). Perhaps more crucially, though, this new approach is actually well-suited with standard silicon CMOS processes. In short, we are nearer than ever before for realizing a commercial graphene computer chip.

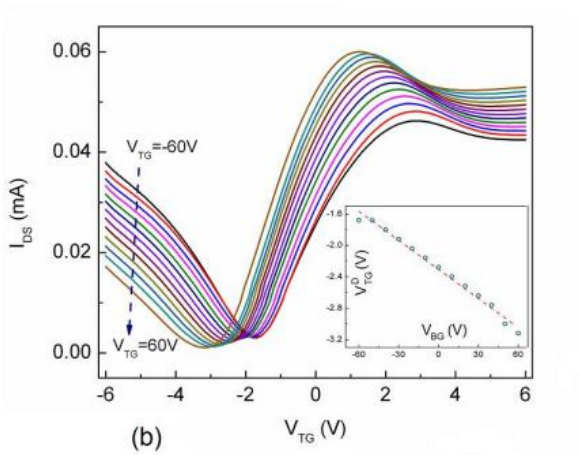


**Fig. Graphene based non-Boolean logic circuit.**

## IV. GRAPHENE IN ADDITIVE MANUFACTURING

Additive manufacturing, usually known as 3-D PRINTING, is the technology that makes it possible to print 3D objects using various predictable materials, including plastic, metal and graphene, compared to the existing 3D printers that only use plastic as material. It can be applied to diverse industrial segments. They depend on a tiny dropper, called a micropipette, which is occupied with graphene oxide sheets. They then add hydrazine to the solution which causes evaporation and allows the graphene to exude from the tiny chemically filled dropper. This, as far as we can tell, is the first illustration in which researchers were able to print 3D pure graphene. It will be interesting to see it as a new trend in the technological wave, particularly for electronics and high tech gadgets.

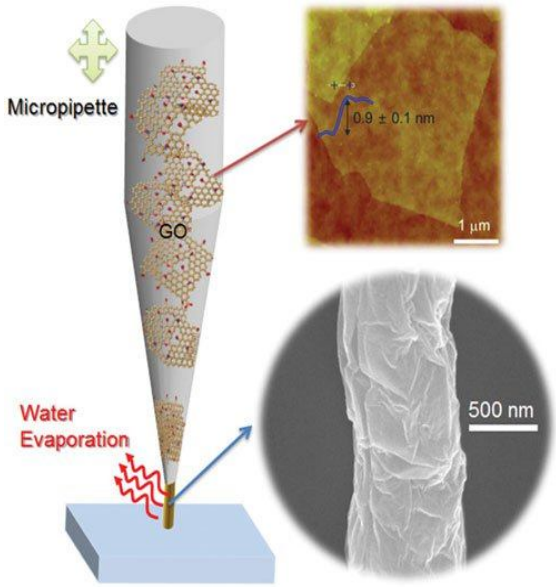


**Fig. Methodology of 3-D printing**

## V. GRAPHENE AS SENSORS

A sensor is a device which detects elements like light, heat, motion, moisture. Responds with an output usually an electrical, mechanical or optical signal. Graphene will enable sensors that are smaller and lighter - providing endless design possibilities. They will also be more responsive, sensitive and able to detect minute and insignificant changes in matter, work very quickly and eventually even be less expensive than traditional sensors. Most of the graphene-based sensor designs contain a Field Effect Transistor (FET) with a graphene channel. Due to its high sensing capabilities, it has a wide spread applications in network protocol. Every device in a network have sensors to sense the dedicated links whether the information is travelling or not. Therefore, using graphene in place of the electronic sensors will be found advantageous. A new way of reading the sequence of chemical bases in DNA is done by sending the molecule through a tiny slit in a graphene sheet.

## VI. GRAPHENE DATABASE

Being the world's thinnest, and high thermal conductive material, it can be used to reduce the size and increase the temperature tolerance of electronic data storage devices.

Table: Currently there are 111 graphene products in our Nano material Database out of which some are mentioned above.

| Company | Material | Thickness | Specification |
|---|---|---|---|
| Applied Nanotech | film | 0.6-12 micron | |
| Graphene Square | film | >80% single-layer | Graphene oxide on copper foil |
| ACS Material | flakes | 0.8-1.2nm | Carboxyl graphene |
| Angstron Materials | flakes | <10nm | Pristine platelets |
| BT Corp | flakes | 3-6 nm | Exfoliated graphene sheets |

Databases are basically linked with the data disks that are present in all the electronic devices for data storage .In the present scenario data disc are usually made up of plastics which takes large amount of space and use it for storage.

It is expected that if plastic will be replaced by the graphene then disc size will get compact and large amount of data will be stored in it. Apart from this fact, it could also tolerate high temperature due to its high thermal conductivity thus increases its reliability.

## CONCLUSION

This paper describes the implementation and application of GRAPHENE which proves it as a wonder material. The possibilities of graphene have proved attractive to scientists. Graphene is undoubtedly emerging as one of the most promising and challenging carbon structure because of its unique combination of superb properties, which opens a way for its exploitation in a wide spectrum of applications ranging from electronics to optics, sensors, and bio devices.

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