Trend of Carbon Nano Tube and Application

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Abstract : Semiconductor fabrication technique has been increasingly developed virtue of greater demands, and supplies and applied semiconductor components in respective processes under development for minuteness. Now semiconductor having a line-width of 75nm was commercialized, and it is possible to scale down to 25nm. Accordingly, to cover with limitations, alternatives are actively investigated. In this paper, we overview the trend and applications of carbon nano tube (CNT) and present the future and technology based on existed theories.

key words : carbon nano tube (CNT)

1. Introduction

Carboon nano tubes are generally hollow cylindrical structures made up of six carbon atoms. After discovered in 1991 by the Japanese electron microscopist Sumio Iijima, they have been stood in the spotlight by most of scientists as a new matter and are called Nano Tubes because of the tiny scaled diameter. In nanoscience objects are measured in nanometers, 1 billionth of a meter. For comparison, the smallest features, measure about 200 nanometers. And a human hair is 100,000 nanometers thick. In CNT, the conductivity is similar to copper and the heat conductivity is same as Aurum. A degree of strength is 100,000 times than steel. For this reasons, CNT are known as crucial technologies in near future.

2. Discussion of CNT

Practical use of carbon nano tube that is called future new site is infinite. It is expected to be widely used to electronics industry as well as daily life. If diameter of this material is regulated conductance changes by semi-conductor and memory chip plan that have tera byte accumulation degree is ten thousand times of existing silicon.

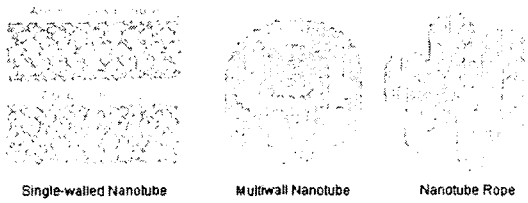

Figure1. Form and kind of carbon nano tube

Technology to make present carbon nano tube are electricity discharge methode, laser ablation, thermal chemistry vapor deposition, plasma chemical vapor deposition, pyrolysis method, and flame composition method.

• Electrical discharge methode: anode and cathode in vacuum chamber each diameter another black lead patch fixed distance method to derive electrical discharge to do. carbon nano tube is created anode and chamber surface side. While this method is superior quality to other types but it is evaluated that the quantity in mass production is problem.

• Laser ablation: Manufacturing processing is similar to electrical discharge methode, but this use laser instead of electrical discharge. Black lead rod aims laser and creates carbon nano tube being evaporated. Quality is most superior, but there is problem of maintenance with laser usage and shortcoming of outturn is minimum. Therefore, it is mainly used in laboratory environment where the properties of research to properties of matter research in a laboratory.

• Thermal chemical vapor deposition: Carbon nano tube grown by dropping gaseous carbon ingredient inside furnace under high temperature. With catalyst, high temperature of 600 ~ 1000℃ is being.

• Plasma chemical vapor deposition: It is a method similar to thermal chemistry vapor deposition but decompose into reaction gas because generating plasma to high frequency power to lower temperature. This method can produce carbon nano tube even low temperature of 400 ~ 500℃.

In the case of present domestic corporation, thermal chemistry vapor deposition and electricity discharge methode are mainly used . Truth that carbon nano tube can work as semi-conductor was already uncovered but it must pass through necessary doping process which is used for semi-conductor device fabrication. On the other hand, carbon nano tube is extremely difficult to dope, so application for semiconductor had been thought with difficulty. Even if tube of rope is not doped deliberately, it was found that wear nature of semiconductor can be doped naturally. This may be caused by tube and tube

interaction and change by semi-conductor such as the biographical nature of doping in conductor as doing interaction.

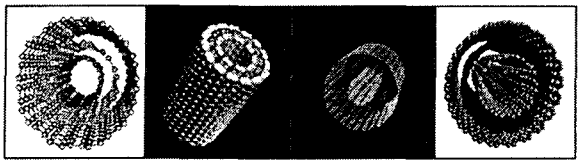

Figure2. multi-walled nanotube

Making storage cell or circuit of size in nano-meter using CNT can raise accumulation degree about one ten-th thousand times smaller than current leading-edge integrated circuit. If become so, this can store near information in hundred times of encyclopedia in area thumb nail. In addition, carbon nano tube is very light because inside is empty. Coherence between carbon atom is stronger than silicon. Because of high coherence between atoms, It is suitable for semiconductor process that must undergo various kinds of chemical process. Because it is chemically stable and thermally emits conduction, heat can be easily sinked than existent silicon semiconductor, so protection gainst heat problem can be solved easily when act as semi-conductor device. There are much objects that must be overcome in spite of numberous advantage as this semi-conductor device. The biggest problem is mass production. High degree of purity must be guaranteed with high volume manufacturing. It is length and radius should also be strictly controlled.

Second, In existent silicon semiconductor produce while repeat much process of production that draw circuit through lithography and etching on the silicon substrate. Case of semiconductor that use CNT is not problem that make electron's transfer passageway how, electron's transfer passageway itself exists already and is problem that arrange the transfer passageway how.

Therefore, need entirely other method with existent manufacture method.

Third, In case use CNT to semi-conductor element, it need semi-conductor nano tube. But, carbon nano tube when grow, it is difficult to grow electively semiconductor carbon nano tube.

In addition, it is very difficult to have refined semiconductor nano tube from grown already carbon nano tubes.

3 . summary

By this time, observed about characteristic of carbon nano tube and possibility as semiconductor element so far. Reason that carbon nano tube does deformity in high potential energy, do not find application easily it because of lacking comprehension and control for carbon nano tube. But, it is sure truth that carbon nono tube is important material. As always, the secret in natural world is not gain easily. Therefore, long term inside measurement and new methodology, ceaseless effort may be the alternative.

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