Properties of graphene essay

Recently, graphene has much attention for researchers due to its interesting properties and advantanges to industries moreover in nanomaterials.

Graphene is a polymer structure made of fused six membered sp^2 hybridized carbon atoms. Graphene is pure carbon in the form of very thin, nearly transparent sheet, basically one atom thick. Graphene is the building block of graphite. Graphene sheets are composed of carbon atoms linked in hexagonal shapes which each of the carbon atom covalently bonded to three other carbon atoms. It is remarkably as a strong for its very low weight, and it conducts heat and electricity with great efficiency. In facts, graphene is a crystalline allotrope of carbon with 2-dimensional sheet of carbon atoms arrayed in hexagonal honeycomb lattice. Graphene can be described as a one-thick layer of graphite. It is basic structural element of other allotropes including graphite, charcoal, carbon nanotubes and fullerenes. Graphene considered as an indefinately large aromatic molecule. The atomic structure of isolated for single layer of graphene was studied by transmission electron microscopy (TEM) on sheets of graphene suspended between bars of a metallic grid. Electron diffaction patterns showed the expected honeycomb lattice. Graphene sheets in solid form usually show evidence in diffraction for graphite's layering. this is true of some single-walled nanostructures.

Generally there are two common properties for each of compound that studied. For chemical properties, graphene is the only form of carbon in which each single atom is in exposure for chemical reaction from two sides due to its 2-dimensional structure. It is known that carbon atoms at the edge of graphene sheets have special chemical reactivity. In fact, graphene has the highest ratio of edge carbons in comparison with similar materials such as carbon nanotubes. The onset temperature of reaction between the basal plane of single-layer graphene and oxygen gas was said to be below 260 ^{o}C while graphene burns at temperature usually 350 ^{o}C. Graphene is chemically the most reactive form of carbon because of the lateral availability of carbon atoms. Commonly, graphene is modified with oxygen- and nitrogen-containing functional groups and then analyzed by infrared spectroscopy and X-ray photoelectron spectroscopy.

From the point of review, the carbon-carbon bond length in graphene is about 0. 142 nanometers. As the nanoscale allotrope of carbon, electrons can only move between carbon atoms in the 2-dimensional lattice. It has shown many intriguing properties including high mobility of charge carriers, unique transport perfomance, high mechanical strength and extremely high thermal conductivity. The carrier moves ballistically over the graphene surface, enabling graphene sheets to conduct electricity very well. The unique properties where electrons obey a linear dispersion relation and behave like massless relativistics particles, resulting in the observation of a number of very peculiar electronic properties such as the quantum Hall effect and transport via relativistic Diracfermions. Other complex interactions between electrons and the hexagonal lattice make graphene transparent, flexible and strong. These properties and others have compelled many researchers over the half-decade to study graphene for a diverse array of uses.

Nowadays, graphene has received much attention recently in the scientific community because of its distinct properties and potentials in nanoelectronic applications. Apart from high electrical conductivity at room temperature, graphene also much potential use as transistor, nano-sensors, transparent electrodes and many other applications. In conclusion, special properties of graphene do not stop with weird physics. As a conductive, electrons are the particles that make up electricity. When graphene allows electrons to move quickly, it is allowing electricity to move quickly. In facts, graphene provide to move electrons 200 times faster than silicon bacause they travel with such little interruption. Graphene is an excellent heat conductor which works normally at room temperature. A sheet of graphene is very strong due to its unbroken pattern and the strong bonds between the carbon atoms. Those strong bonds make graphene very flexible, where it can be twisted, pulled and curved to a certain extent without breaking. Graphene absorb 2. 3 percent of the visible light that hits it, which means we can see through it without to deal with any glare.

Synthesis of graphene much more benefit in nanomaterials. Nanomaterials and nanotechnology are new ï¬elds of science and technology. Fundamentally, nanotech-nology is about manipulating and making materials at the atomic and molecular levels. It is expected that nanotechnology will change solid-state gas sensing dramatically and will probably gain importance in all ï¬elds of sensor application over the years. Nanotechnology is still in its infancy, but the ï¬eld has been a hot area of research globally since a few years ago. It has been found that with reduction in size, novel electrical, mechanical, chemical, catalytic, and optical properties can be introduced. As a result, it has been concluded that one-dimensional structures will be of beneï¬t for developing new generation chemical sensors that can achieve high performance. Therefore, in the last decade, the study of nanomaterials has become a primary focus in the ï¬eld of chemical sensor design (Das & Prusty, 2013).

In addition, graphene is the thinnest sheet-shaped molecules with an ultrasurface area. It have great uses in application in electronic devices, sensors, electrodes and other graphene composite materials. (Yang, Ratinac, Ringer, Thordason, Gooding & Braet, 2010). As we know, graphene have lot of potential, large scale production of graphene with the best quality giving chances to synthesis the graphene for industrialization. There are many methods in order to get the graphene sheet such as chemical vapor deposition (CVD) of hydrocarbons on transition-metal substrates and epitaxial growth via high temperature treatment of silicon carbide, micromechanical exfoliation and cleavage. Although it can be provided graphene in large quantities, but that methods are difficult to scale up and need high level of knowledge and understanding about it equipment. In addition, these methods need high energy requirement and limitation of instrument.

Herein are some of application and important of graphene to bioengineering, composite materials, energy technology and nanotechnology. Bioengineering will certainly be a field in which graphene will become a vital part of in the future although some obstacles need to be overcome before it can be used. However, the properties that it displays suggest that it could revolutionize this area in a number of ways. With graphene offering a large surface area, high electrical conductivity, thinness and strength, it would make a good candidate for the development of fast and efficient bioelectric sensory devices, with the ability to monitor such things as glucose levels, haemoglobin levels, cholesterol and even DNA sequencing. Eventually we may even see engineered ‘ toxic’ graphene that is able to be used as an antibiotic or even anticancer treatment. In addition, due to its molecular make-up and potential biocompatibility, it could be utilised in the process of tissue regeneration.

In optical electronics, graphene used on a commercial scale is that in optoelectronics, specifically touchscreens, liquid crystal displays (LCD) and organic light emitting diodes (OLEDs). It is also highly conductive, as we have previously mentioned and so it would work very well in optoelectronic applications such as LCD touchscreens for smartphones, tablet and desktop computers and televisions.

Graphene is strong, stiff and very light. Currently, aerospace engineers are incorporating carbon fibre into the production of aircraft as it is also very strong and light. However, graphene is much stronger whilst being also much lighter. Ultimately it is expected that graphene is utilized probably integrated into plastics such as epoxy to create a material that can replace steel in the structure of aircraft, improving fuel efficiency, range and reducing weight. Due to its electrical conductivity, it could even be used to coat aircraft surface material to prevent electrical damage resulting from lightning strikes. In this example, the same graphene coating could also be used to measure strain rate, notifying the pilot of any changes in the stress levels that the aircraft wings are under. These characteristics can also help in the development of high strength requirement applications such as body armour for military personnel and vehicles.

Furthermore, graphene can uses as a sensor to diagnose some diseases. These sensors are based upon graphene where it have large surface area and the fact that molecules that are sensitive to particular diseases can attach to the carbon atoms in graphene. For example, researchers have found that graphene with strands of DNA and fluorescent molecules can be combined to diagnose diseases. A sensor is formed by attaching fluorescent molecules to single strand DNA and then attaching the DNA to graphene. When an identical single strand DNA combines with the strand on the graphene, a double strand DNA is formed that floats off from the graphene, increasing the fluorescence level. This method results in a sensor that can detect the same DNA for a particular disease in a sample. It also use as membranes for more efficient separation of gases. These membranes are made from sheets of graphene in which nanoscale pores have been created beecause graphene is only one atom thick where gas separation will require less energy than thicker membranes.