Course: *Fundamental Properties of Solids*

Submitted to

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Dated: 19 March, 2014

A review on article “Graphene Synthesis & Applications”

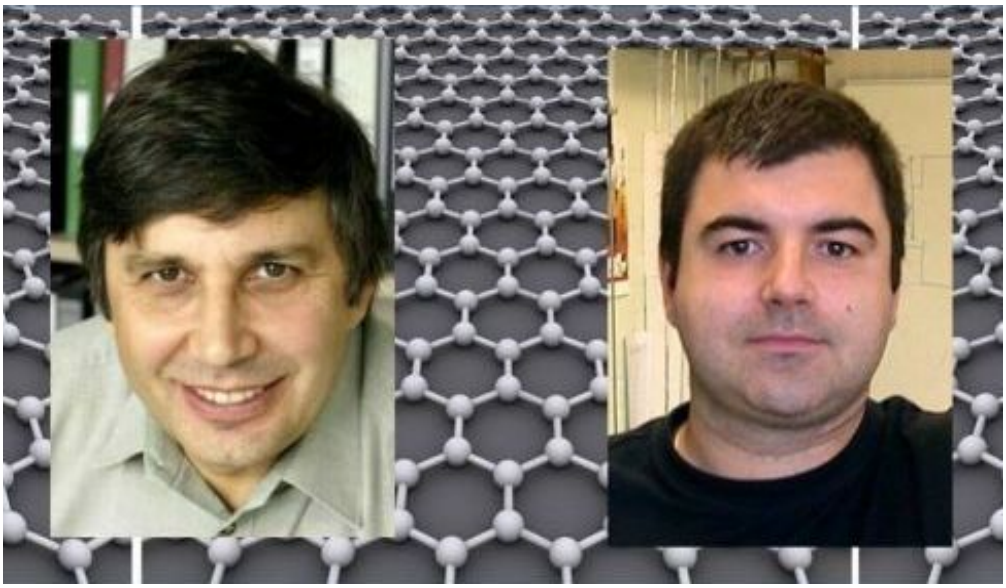
Contents

Abstract Summary

Graphene is a form of carbon consisting of planar sheets which are one atom thick, with the atoms arranged in a honeycomb-shaped lattice. Graphene has been synthesized in various ways and on different substrates. This article is totally about the synthesis process, properties, and applications of Graphene.

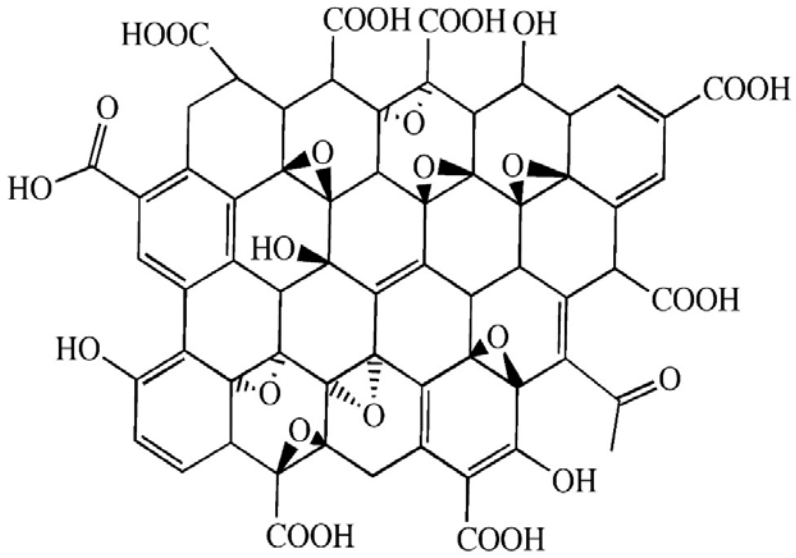
Introduction:

The theory of graphene was first explored by P. R. Wallace in 1947 as a starting point for understanding the electronic properties of 3D graphite. In 2004 Andre Geim and Kostya Novoselov at University of Manchester extracted single-atom-thick crystallites (graphene) from bulk graphite: Pulled out graphene layers from graphite.



Graphene structure

In graphene, carbon atoms are densely packed in a regular sp^2-bonded atomic-scale (hexagonal) pattern.
It is a form of carbon consisting of planar sheets.

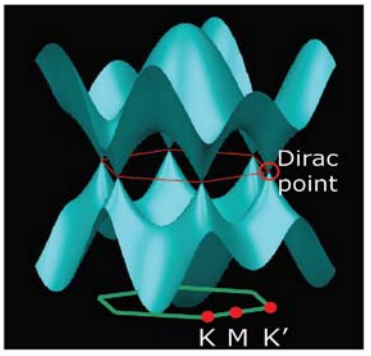


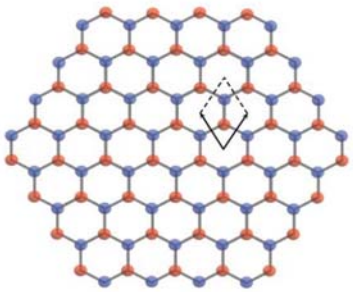
This shows Graphene structure

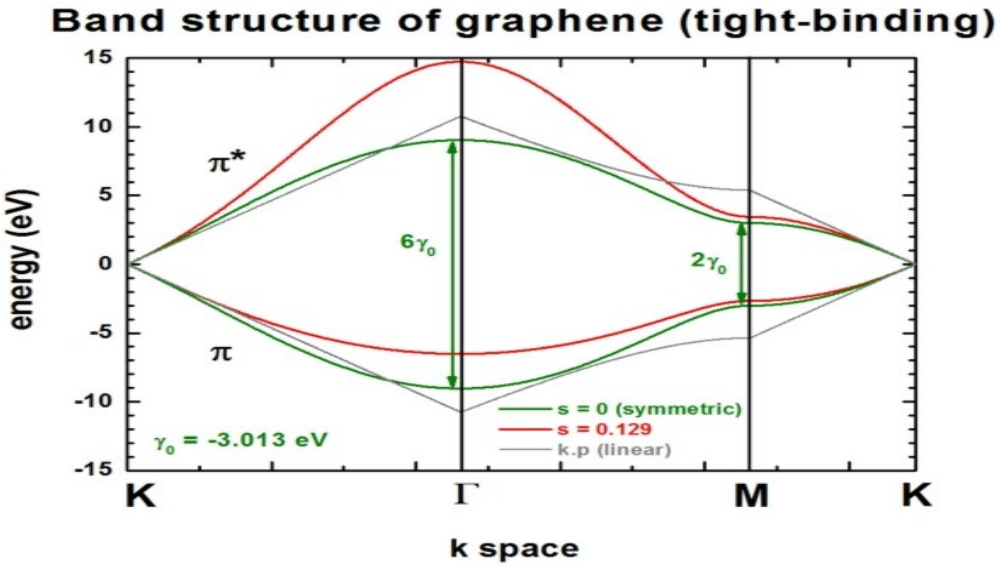
It is carbon to carbon atom which is very strong & this doesn't allow vibration fluctuations.

The largest known isolated PAH molecule consists of 222 atoms and is 10 benzene rings across.

Dirac point and Band structure of Graphene:







Properties of graphene:

- ❖ Electronic properties
- ❖ Mechanical properties
- ❖ Thermal properties
- ❖ Optical properties
- ❖ Chemical properties

Preparation and characterization of Graphene:

There are 2 methods of preparing Graphene. One is Exfoliation Furthermore it include 4 different methods.

- ❖ Scotch-tape method
- ❖ Dispersion of graphite
- ❖ Graphite Oxide Exfoliation
- ❖ Substrate Preparation

Other is Growth on surface

- ❖ Epitaxial Growth
- ❖ Chemical Vapor Deposition

Most commonly used method in industry is chemical vapor deposition (CVD) , epitaxial growth is dead end technique. Pure graphene is formed by exfoliation method.

Applications

- ❖ Graphene in optoelectronics
- ❖ Graphene in electronics
- ❖ Graphene in photonics
- ❖ Graphene in Transistor
- ❖ Graphene in Ultrafiltration
- ❖ Graphene in energy storage
- ❖ Grapheme in biological engineering
- ❖ Grapheme in composite material

Conclusion

In this review we have presented some of the recent progress in graphene synthesis, and applications. The research in this area is still in an early development stage and much more work is needed to realize graphene's technological potential.
We should expect many other applications that exploit the Unique properties of graphene to appear in the coming years.