Octahedral panels

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http://homepage.mac.com/whitby/

http://web.me.com/whitby/Octahedron/Welcome.html

References

1. Octahedron1stEd.pdf The octahedral periodicity of the Atomic Elements and its implications.

http://homepage.mac.com/whitby/FileSharing103.html

2. Novoselov, K.S., A.K. Geim, et al. 2004. Electric field effect in atomically thin carbon films. Science 306(Oct. 22):666-669.

http://www.sciencemag.org/cgi/content/abstract/306/5696/666.

3. Discovery of Two-Dimensional Fabric Denotes Dawn of New Materials Era University of Manchester press release of 18 October 2004

http://www.manchester.ac.uk/pressnews/discoveryoftwo-dimensionalfabric/

Introduction

This paper has been prompted by this excerpt from Reference 3–

<The team led by Professor Andre Geim at The University of Manchester, has succeeded in extracting individual planes of carbon atoms from graphite crystals, which has resulted in the production of the thinnest possible fabric - graphene.>

This paper shows that the thinnest possible planar assembly would be composed of deuterium atoms. It would be one-fourth as thick as graphene.

Two planar assemblies of atoms would be one-half as thick as graphene–one composed of deuterium triplets, the other composed of single C-atoms.

Each of the four planar assemblies is viewed normally to the plane it defines in Figure 1.

In Figure 2, to show the thickness of the assembly, an atom from each of the four assemblies is shown in a view parallel to the plane of its assembly.

Planar assemblies of atoms

C-atom tetrahedra

Graphene is a planar assembly composed of identical open-faced tetrahedra consisting of three C-atoms each. The assembly results from the triplet-to-triplet joining of a C-atom of one tetrahedron with the C-atom of an inverted tetrahedron. [See Figure 1.] The assembly is two He-octa facial diameters thick.

Single C-atoms

C-atoms can make a planar assembly in which each of the three He-octas of each C-atom participates in the formation of a triplet with a He-octa of two other C-atoms. [See Figure 1.] This assembly is just one He-octa facial diameter thick, or one-half the thickness of a graphene layer.

Deuterium tetrahedra

Like the C-atom, the deuterium atom is an octahedral triplet. Three D-atoms could assemble as an open-faced tetrahedron. Identical D-tetrahedra could form a planar assembly in which the join between a D-atom of one tetrahedron makes a triplet-to-triplet join with the D-atom of an inverted tetrahedron. [See Figure 1.] The assembly is one He-octa facial diameter thick.

Single Deuterium atoms

D-atoms can make a planar assembly in which each of the three epn-octas of each D-atom participates in the formation of a triplet with an epn-octa of two other C-atoms. [See Figure 1.] this assembly is one-half of a He-octa facial diameter thick.

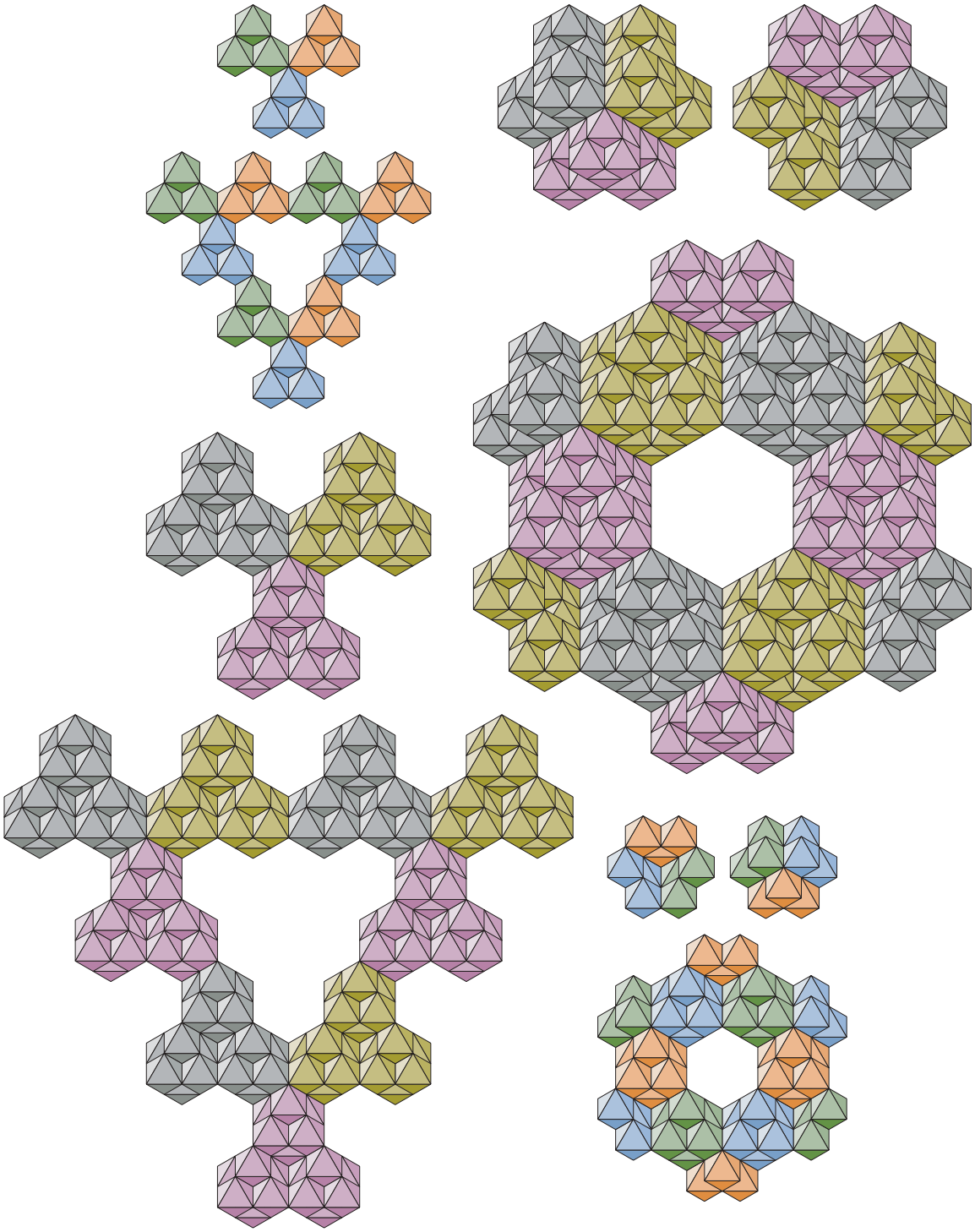

Fig. 1 Planar assemblies of C-atoms and deuterium atoms.

On the left, the plane of the atom parallels the plane of the assembly; on the right, the plane of atom is not parallel to the plane of the assembly. At top left, the triplets are D-atoms; at bottom left, the triplets are C-atoms. At top right, the tetrahedra are composed of C-atoms; at bottom right, they are D-atoms

Fig. 2 Planar assemblies of C-atoms and deuterium atoms–thickness

The orange epn-triplets at the top of the figure are D-atoms. The D-atom on the left is from a tetrahedral assembly. The upper view is normal to the plane of the assembly; the lower view is parallel to the plane and shows its thickness. The D-atom on the right is from a single atom assembly. It is viewed normally, and then parallel to the plane of its assembly to show its thickness.

The violet He-octa triplets at the bottom are C-atoms. The C-atom on the left is from the tetrahedral assembly of a graphite CFU; the one on the right is from a single atom assembly. The thickness of the graphite assembly is shown to be twice that of the single atom assembly, twice that of the D-atom tetrahedral assembly, and four times that of the single D-atom assembly.