Tubular assemblies of fivefold rings of graphite CFUs

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

References

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

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

2. GraphitePanels.pdf Triangular panels composed of graphite CFUs

http://homepage.mac.com/whitby/Quasicrystals/FileSharing175.html

3. DiamondPanels.pdf Triangular panels composed of diamond CFUs

http://homepage.mac.com/whitby/Quasicrystals/FileSharing176.html

4. Tubes.pdf Hinge-joined octahedra–rings, tubes, and hubs

http://homepage.mac.com/whitby/Quasicrystals/FileSharing75.html

5. DiamondTubes.pdf Tubular assemblies of fivefold rings of diamond CFUs

http://homepage.mac.com/whitby/Quasicrystals/FileSharing181.html

Introduction

This file shows how rings of graphite CFUs can join to form pentagonal and decagonal cylindrical assemblies.

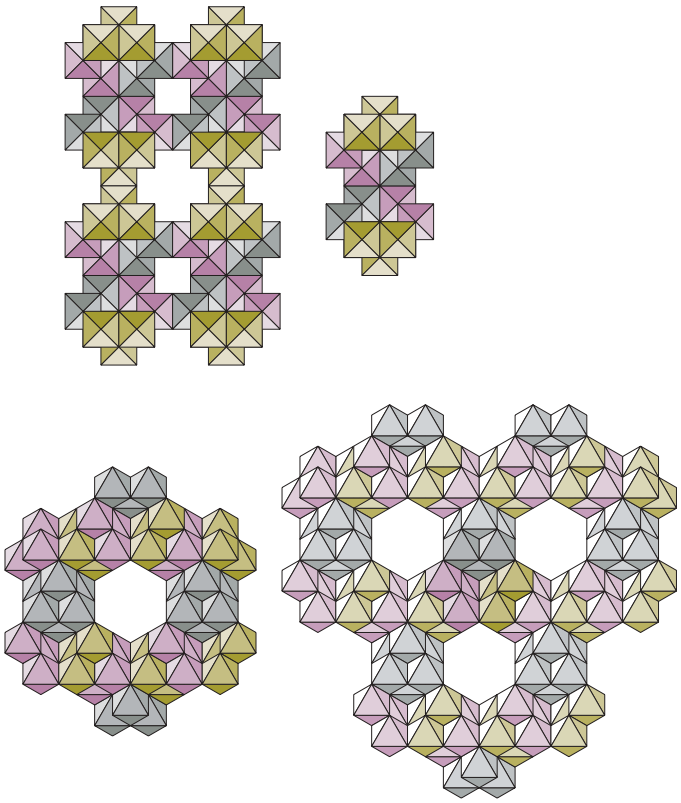

Fig. 1 Graphite–hexagons and pseudo-hexagons

There is a ring of six graphite CFUs of three C-atoms each at the bottom left.

At bottom right there is a three ring assembly of thirteen graphite CFUs. The central CFU is at full color while the remaining twelve are faded. It is seen that this central CFU is an integral part of three different rings. The three C-atoms of the CFU are shared equally by the three rings. The same is true for each and every CFU within the crystal plane of graphite. Each ring has a one third share of each of six CFUs. It follows that each ring accounts for six C-atoms. As is shown on the bottom left, a lone graphite ring requires no less than six CFUs of three C-atoms each. The threefold axis of each CFU in a ring lies on a vertex of a regular hexagon. The ring structure of graphite is absolutely rigid. There is absolutely no way that this structure can be rolled up into a tube or anything else at the nanotube level.

At top right, there is a pair of hinged graphite CFUs which have six C-atoms between them in what might be called an hexagonal arrangement. A He-octa edge of each of two C-atoms of one CFU is joined to a He-octa edge of each of two C-atoms of the other CFU. This is not stable by itself. If each of the CFUs is part of a hinged circumferential ring of identical CFUs, the relationship between them will be stabilized. A portion of a tubular assembly of four identically paired graphite CFUs is shown at upper left. The axis of the tube would run parallel to the right side of the page; the plane of the circumferential ring would be parallel to the bottom of the page. This assembly of hinged CFUs will roll up into a tube which can be stabilized in a manner similar to that of a diamond tube. [See Reference 5.]

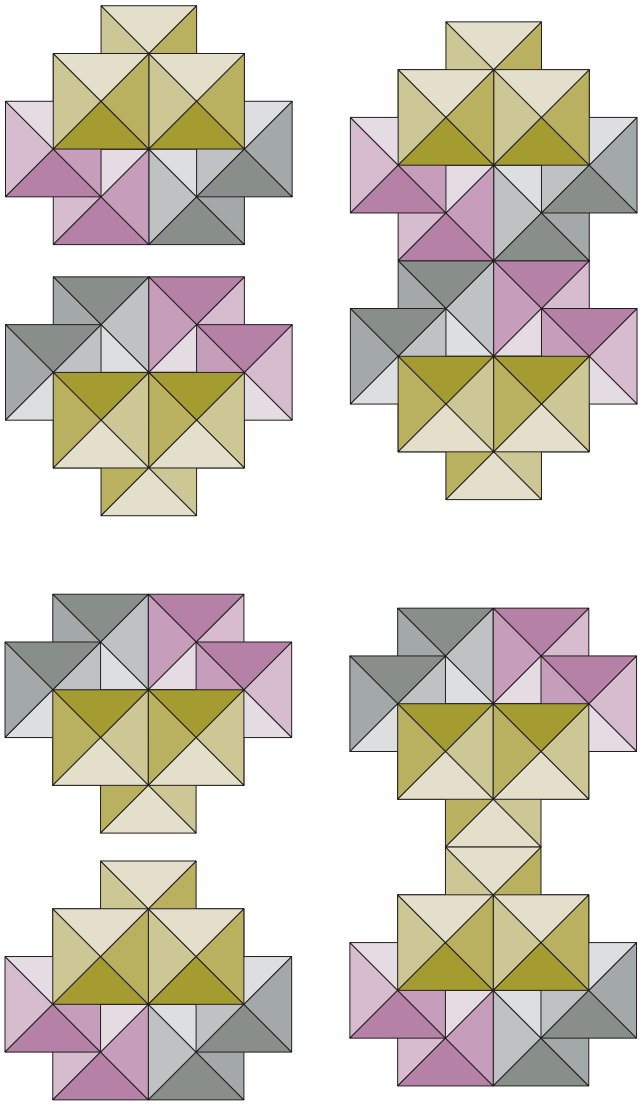

Fig. 2 Joining of graphite CFUs for tube forming.

The figure shows how graphite CFUs must join along the axial direction so as to be able to form the hinged circumferential rings used in tubular assemblies. The joins between CFUs in each ring must be hinged and lie on the same circle, and the hinges of the axially stacked rings must be colinear.

The axial joins between the graphite CFUs are of two types. The top pair is joined by a pair of He-octa edges; the bottom pair is joined by a single He-octa edge.

The CFUs of each pair differ by a rotation of one half turn about a normal to the graphical plane.

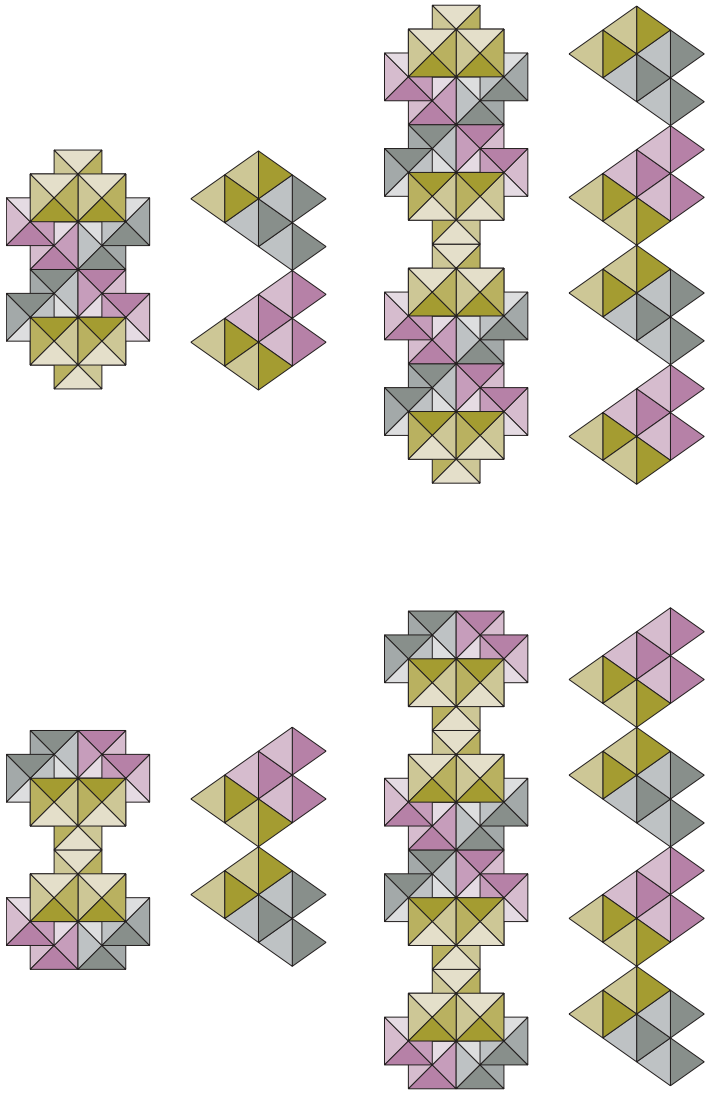

Fig. 3 Axial stacking of hinged graphite CFUs in tubular assemblies

The two types of axial joins between two graphite CFUs are shown here from two different directions. The two edge join is shown at the top; the one edge join is shown at the bottom. Each shows the pair in the radial direction on the left and the tangential direction on the right. Each shows two pairs joined axially in both radial and the tangential views. It can be seen that the gray-violet two edge join is not in the same column as the yellow-yellow one edge join.

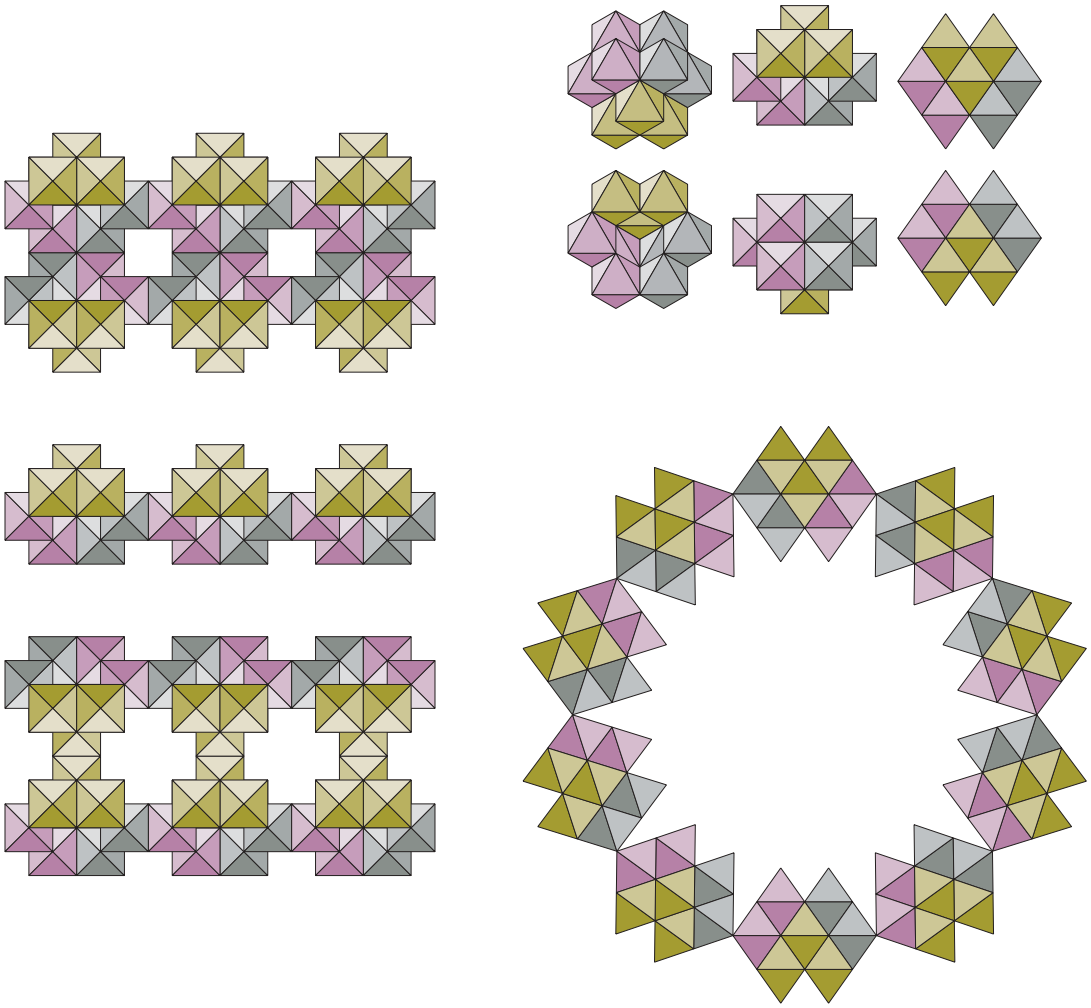

Fig. 4 Circumferential assembly of hinge joined graphite CFUs

The figure shows how graphite CFUs can form a circumferential ring suitable for a tubular assembly. A graphite CFU is shown in three views and their obverse in the top right. A circumferentially hinged strand of three graphite CFUs is shown in the middle left. At top left, a strand has been axially joined to a second stand which differs by a rotation of a half turn about a normal to the graphical plane. The join between the CFUs of each strand is violet-gray two edges. At bottom left, the same two strands are joined yellow-yellow one edge.

In bottom right, a ring of ten hinged graphite CFUs is viewed axially.

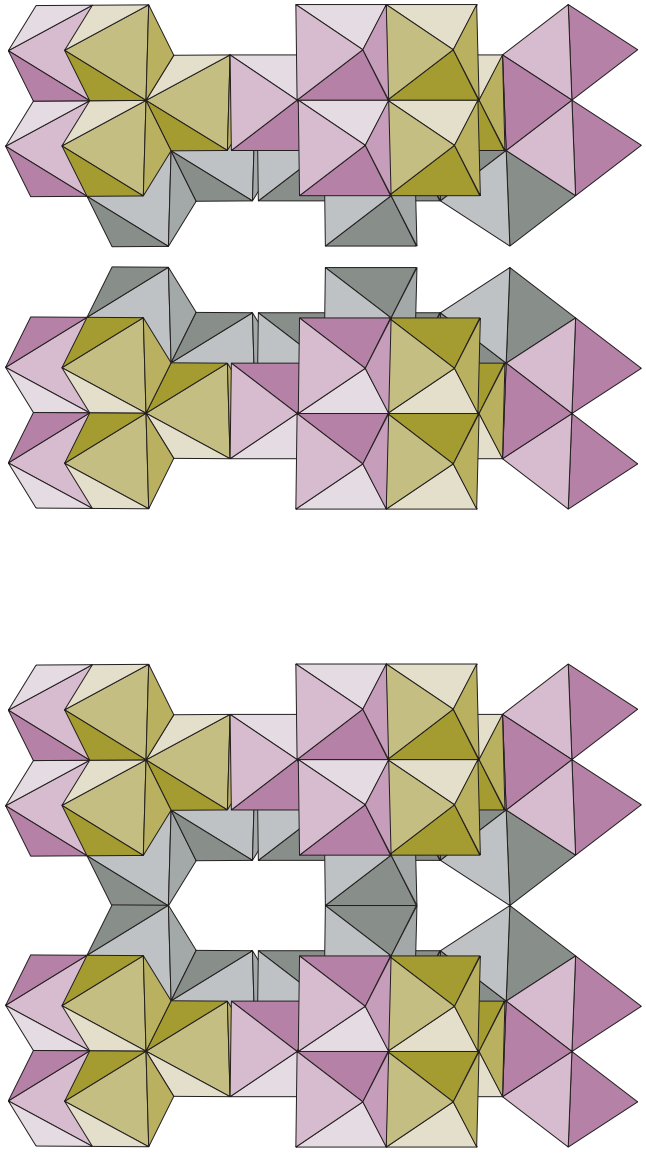

Fig. 5 Icosahedral ring of five graphite CFUs

At top, the figure shows a pair of rings each having five graphite CFUs in an icosahedral orientation. The rings are mirror opposites.

At bottom, the rings have been joined. A He-octa edge of each of five gray colored C-atoms of one ring is joined with a He-octa edge of a gray colored C-atom of the other ring. Each of the rings is unstable by itself; together, they are a stable assembly.

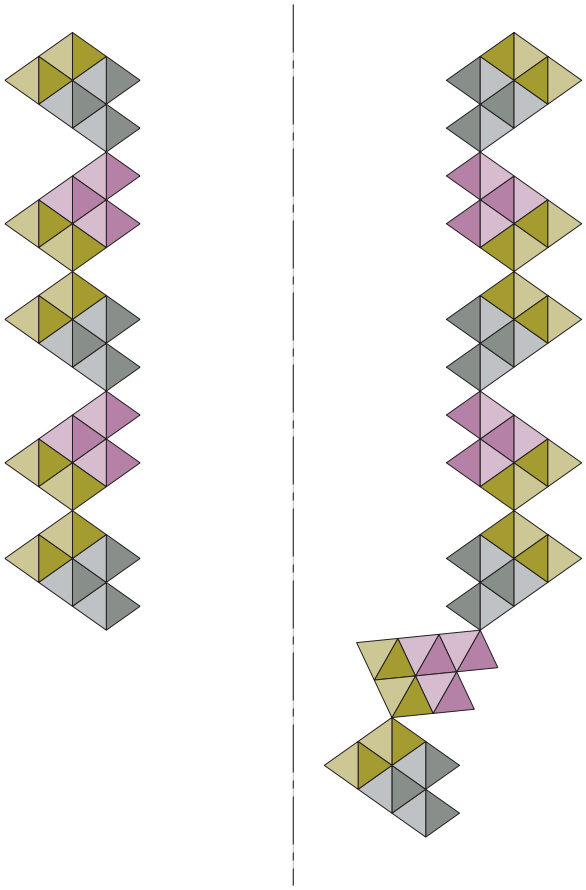

Fig. 6 Linking a decagonal tube to a pentagonal ring with additional CFUs
The figure shows a decagonal tube of paired decagonal rings of graphite CFUs which has been linked to a pentagonal ring of graphite CFUs. The structure is similar to that for diamond CFUs shown in Reference 5. Only one set of diametricly opposed CFUs are shown.