Tetrapod structure

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

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

References

1. Octahedron, the Universe defined by Robert William Whitby

A description of the atomic shapes and how they join which follows from the discovery that the periodicity of the atomic elements matches the periodicity of recurring form in which identical regular octahedra combine to form ever larger regular octahedra. Octahedron1stEd.pdf shows that the atomic elements are crystalline assemblies of identical regular octahedra and explores the implications of this discovery. 500 pages
http://homepage.mac.com/whitby/FileSharing103.html

2. Synthesis and optical properties of tetrapod-like zinc oxide nanorods by Y. Dai, Y. Zhang, Q.K. Li, C.W. Nan, 24 May 2002, Chemical Physics Letters 358 (2002) 83–86

On page 84, Figure 1(b) shows a ZnO tetrapod at high magnification.
http://www.paper.edu.cn/scholar/download.jsp?file=zhangyue-3

3. Growth mechanism and properties of ZnO nanorods synthesized by plasma-enhanced chemical vapor deposition by Xiang Liu, Xiaohua Wu, Hui Cao, and R. P. H. Chang, Journal of Applied Physics, v. 95, no. 6, 15 March 2004, pp. 3141-3147

Nanorods grow normal to the c(0001) plane of sapphire and the 111-plane of platinum. (page 3144, col.2).
http://www.physics.northwestern.edu/Cao/JAP04.pdf

Introduction

ZnO forms rods which are normal to the c(0001) plane of a sapphire crystal and the 111-plane of a platinum crystal. [Reference 3]. Each of the crystal planes is perpendicular to a facial diameter of the regular octahedron. It follows that the ZnO rod is parallel to the facial diameter of the regular octahedron. In a crystalline assembly, there are eight rod directions from a given octahedral hub. A 1-octa mounted on the face of a 2-octa provides a simple rod-forming unit. Figure 1 shows identical units in each of the eight possible facial orientations.

Figure 2 shows how one group of four orientations can make four rods of two units each which join so that each rod is perpendicular to the face of a regular tetrahedron.

Figure 3 shows how the second group of four orientations can make an identical tetrahedral assembly.

Tetrapod I of Figure 2 and Tetrapod II of Figure 3 have the form of the ZnO tetrapod shown in Figure 1(b) of Reference 2.

Figures 4 and 5 show how an O-atom can join with a Zn-atom to form a 3-octa consisting of nineteen He-octas–the form of the Sr-atom. The ZnO-group has a regular octahedral form. Six ZnO-groups can form a 2-octa; mounting another ZnO-group on a face of the 2-octa produces a building unit with the same form as that used to produce the tetrapods of Figures 2 and 3.

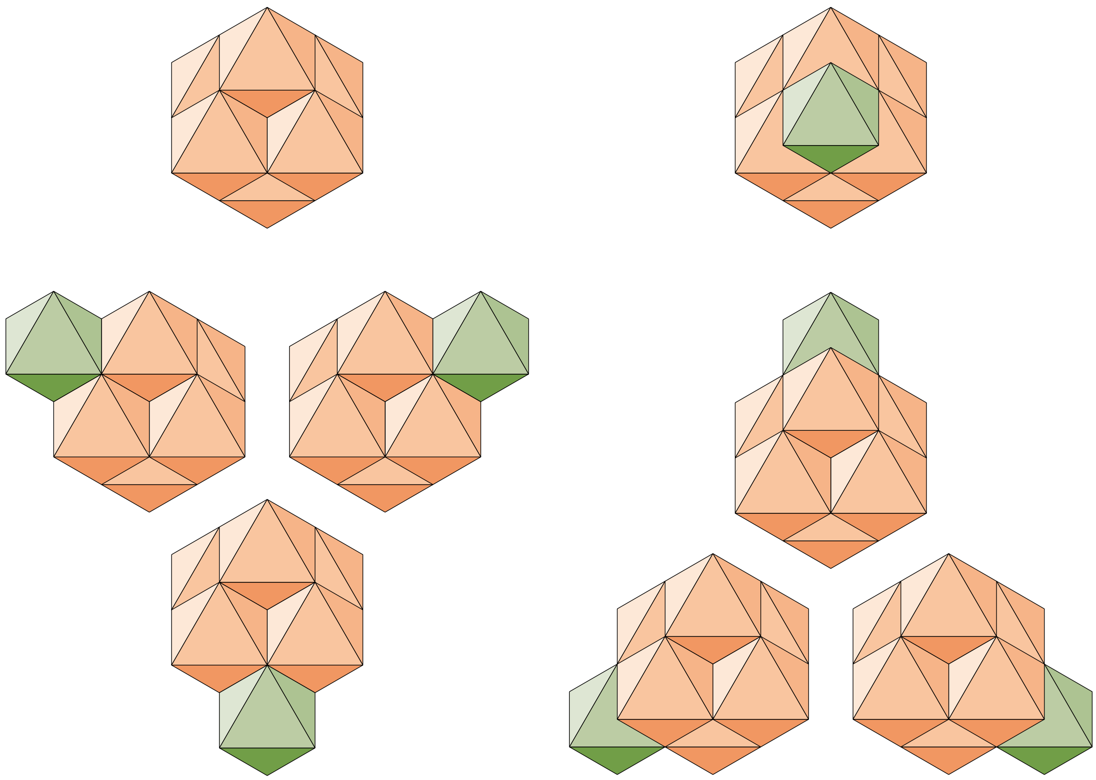

Fig. 1 Building units to make rods with axes parallel to the facial diameters of the octahedron
The figure shows identical building units in the eight orientations to build rods parallel to the facial diameters of the regular octahedron. The building unit consist of a green 1-octa crystallinely joined to a face of a red 2-octa. This is the form of the Si-atom in which each of the seven octahedra is a He-octa and the green octa is the Si-octa.

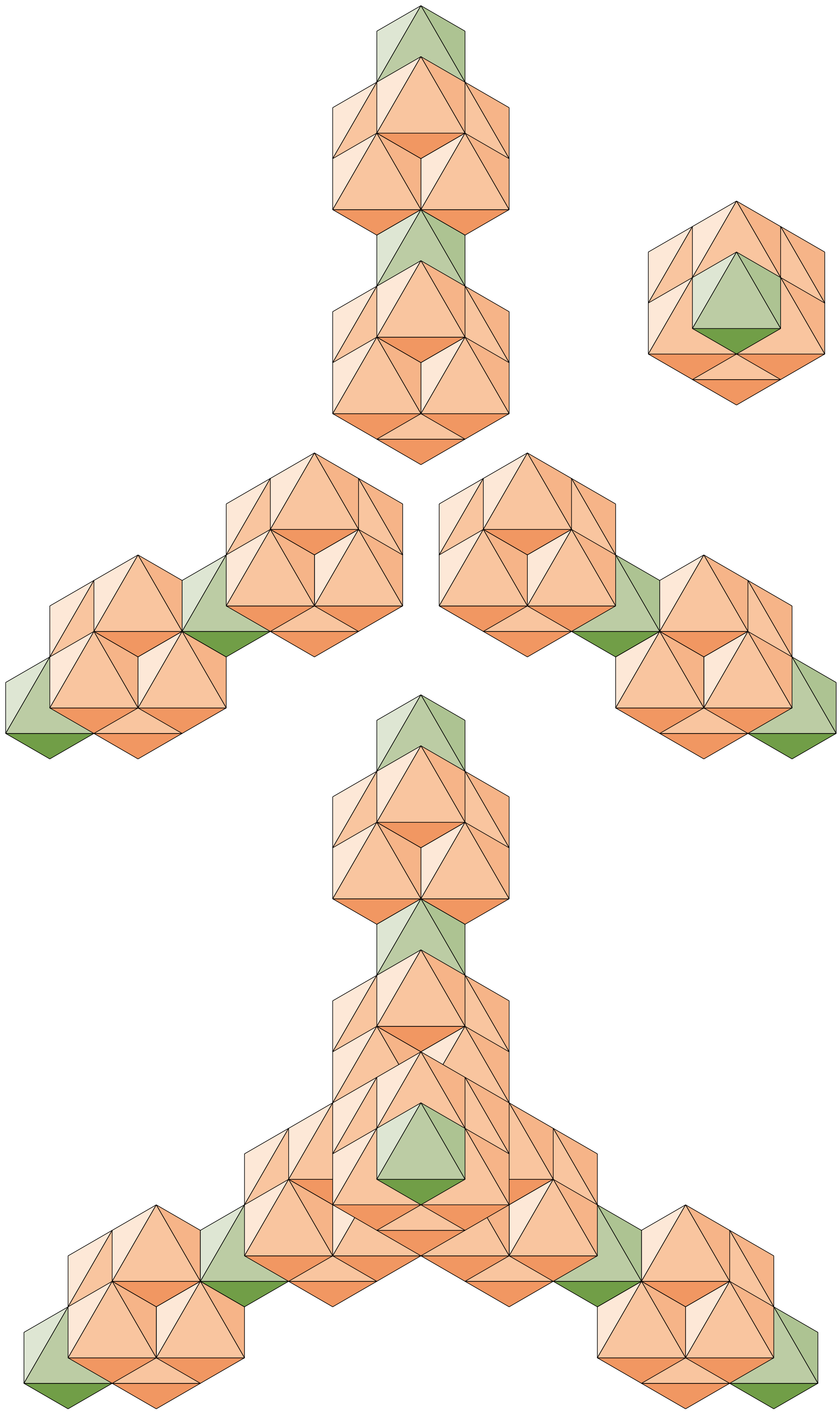

Fig. 2 Tetrapod I

Four rods consisting of two units each are shown at the top. The rods are assembled as a tetrapod at the bottom. Each leg is perpendicular to a set of octahedral faces which define a regular tetrahedron.

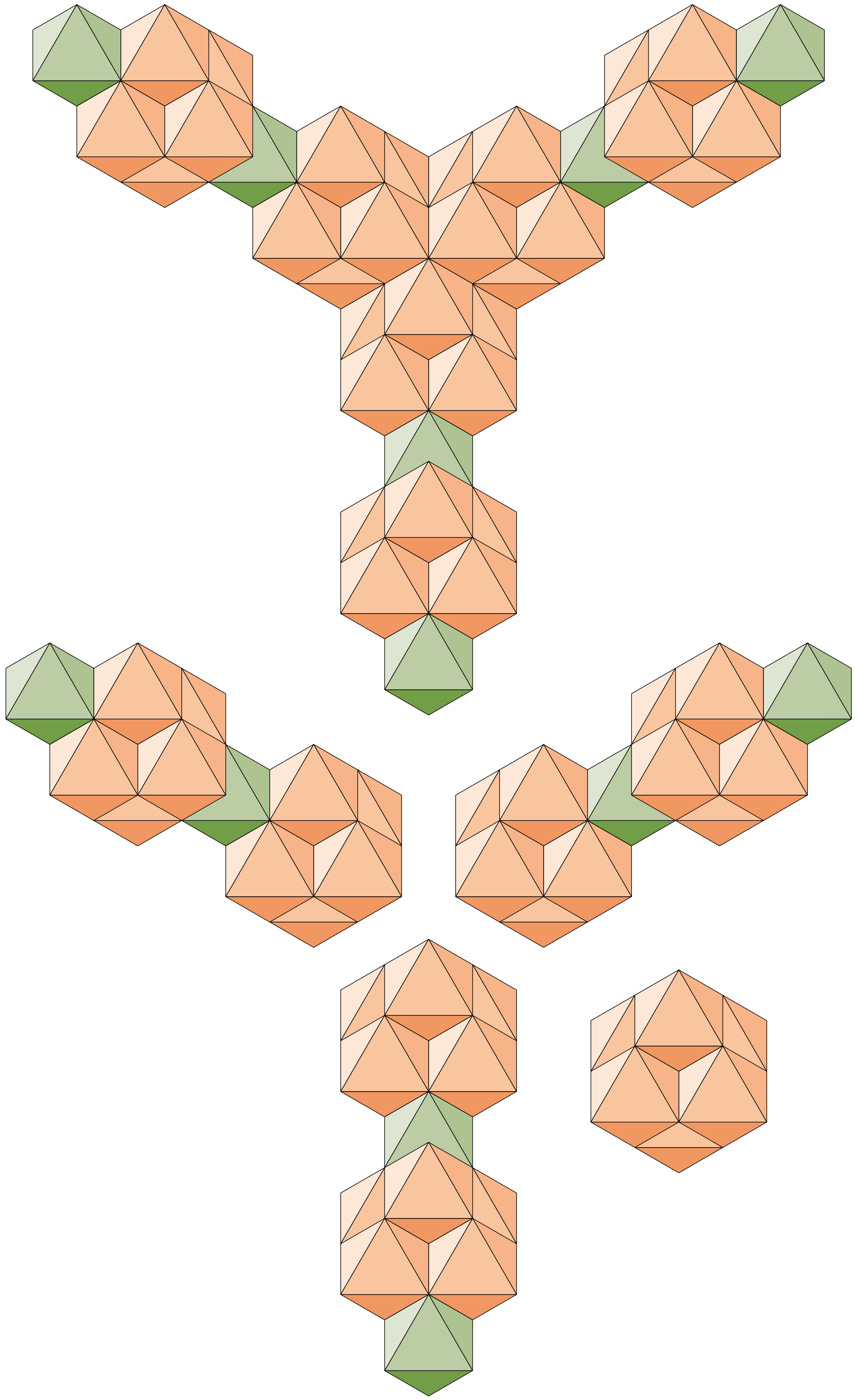

Fig. 3 Tetrapod II

The figure shows a second set of four rods composed of two units each at the bottom. The rods are assembled as a tetrapod at the top.

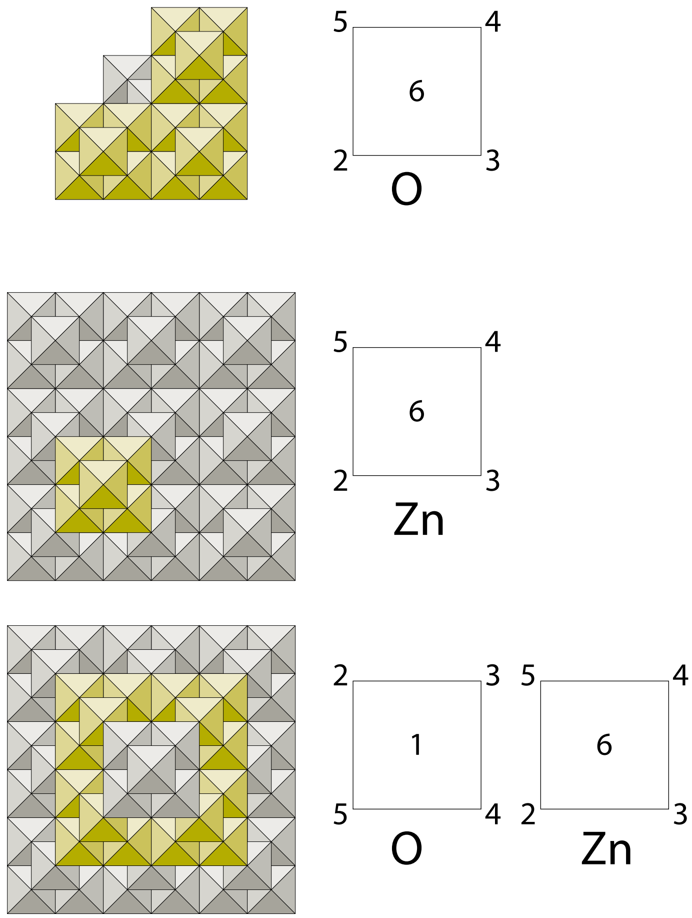

Fig. 4 ZnO-group

The figure shows how an O-atom can join with a Zn-atom to form a ZnO-group.The three yellow He-octas of the O-atom fill the three voids of the 4-layer of the Zn-atom. The group has the same form as the Sr-atom

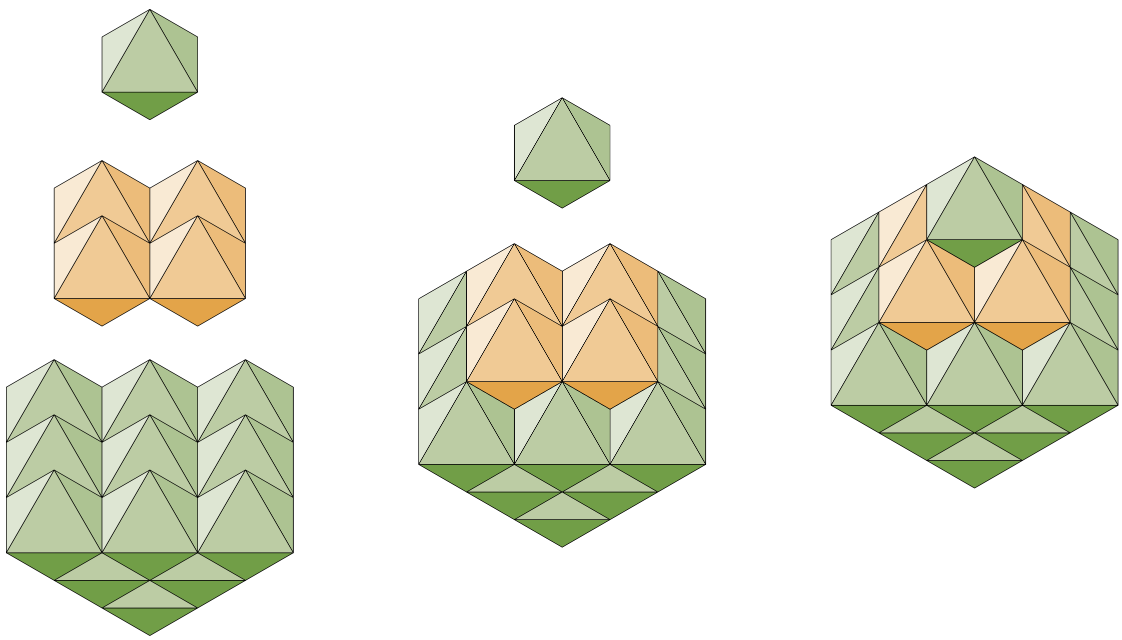

Fig. 5 ZnO-group–facial view, He-octa detail

The figure shows the formation of the ZnO-group in an octahedral facial view.

At left, the four orange octahedra are the Ca-octa of the Zn-atom and the Be-, C-, and O-octas of the O-atom. The lone octa at the top is the He-octa of the O-atom; the fourteen green octas at the bottom belong to the Zn atom.

In the middle, the layer of orange octas is joined with the green pyramid of the Zn-atom.

At right, the He-octa of the O-atom is joined to the orange layer completing the ZnO-group. Like the Sr-atom, the nineteen He-octas of the group has the form of a 3-octa.