

Difference Between Tetrahedral and Octahedral Voids

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Key Difference - Tetrahedral vs Octahedral Voids

When considering closely packed [inorganic substances](#), there are empty spaces that are known as voids. Voids are unoccupied, empty spaces of unit cells in inorganic substances. A unit cell is a fundamental unit that shows the chemical arrangement of the whole substance that is composed of repeating units. The [atoms, molecules](#) or [ions](#) that the crystal system is made up of are generally known as spheres. In closely packed solid substances, there are two types of voids that can be observed; tetrahedral voids and octahedral voids. The **key difference** between tetrahedral and octahedral void is that **tetrahedral voids are visible in substances having tetrahedral crystal systems whereas octahedral voids are visible in substances having octahedral crystal systems.**

What are Tetrahedral Voids?

Tetrahedral Voids are unoccupied, empty spaces present in substances having tetrahedral crystal systems. Therefore, this void occurs in between four constituents. A tetrahedral void is formed when one atom (or sphere) is placed under depression formed by three other atoms (or spheres). Hence, two atomic layers are involved in the formation of a tetrahedral void.

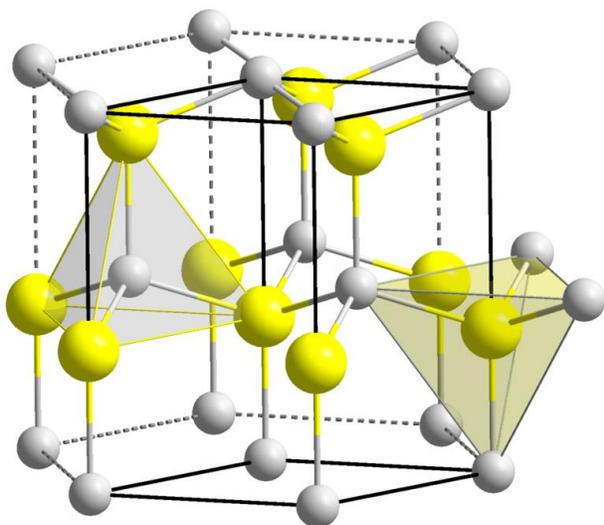


Figure 1: Two Tetrahedral Voids.

However, the shape of the tetrahedral void is not tetrahedral, only the arrangement of four particles around the void is tetrahedral. The shapes of voids are very complicated. The volume of a tetrahedral void is much smaller than that of an atom (or sphere) which cause the formation of the void. Larger the size of particles around the void, larger the size of the void. The coordination number of the tetrahedral void is four. Here, the term coordination number stands for the number of atoms or ions immediately surrounding the void. In the crystal system, there are two voids per sphere (atom). These voids and their sizes have a great influence on the material properties.

What are Octahedral Voids?

Octahedral voids are unoccupied, empty spaces present in substances having octahedral crystal systems. An octahedral void is formed in between six atoms (or spheres). There, three closely packed atoms (or spheres) form an equilateral triangle and are placed over the other three atoms causing a void to form. Here also two atomic layers are involved in the formation of the void.

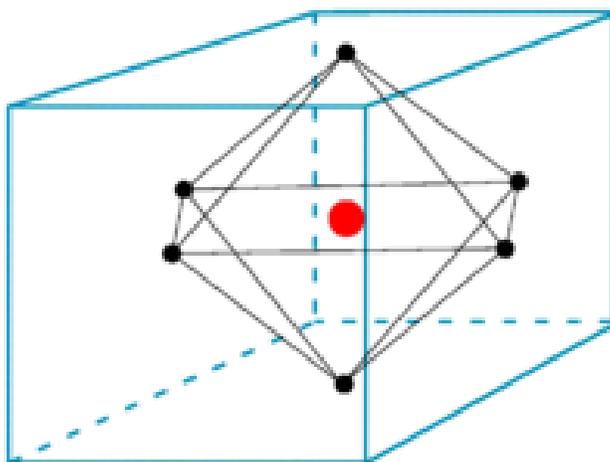


Figure 2: An Octahedral void at the centre of the unit cell.

The volume of an octahedral void is very small when compared with a tetrahedral void. When a unit cell of a substance (having an octahedral arrangement) is considered, there is one octahedral void at the centre of the unit cell, and the coordination number of this void is six since six atoms surround it. In a crystal [lattice](#), there is one void per one sphere (or atom).

What are the Similarities Between Tetrahedral and Octahedral Voids?

- Both are voids present in crystal lattices.
- Both are smaller than the spheres that build up the crystal lattice.

What is the Difference Between Tetrahedral and Octahedral Voids?

Tetrahedral Voids vs Octahedral Voids	
Tetrahedral Voids are unoccupied, empty spaces present in substances having tetrahedral crystal systems.	Octahedral voids are unoccupied, empty spaces present in substances having octahedral crystal systems.
Crystal System	
Tetrahedral Voids can be found in substances having a tetrahedral arrangement in their crystal system.	Octahedral Voids can be found in substances having an octahedral arrangement in their crystal system.
Location in the Unit Cell	
Tetrahedral Voids can be observed in edges of the unit cell.	Octahedral voids can be observed in the centre of the unit cell.
Coordination Number	
The coordination number of the tetrahedral void is four.	The coordination number of the octahedral void is six.
Number of Voids in the Crystal Lattice	
There are two tetrahedral voids per sphere in the crystal lattice.	There are one octahedral void per sphere in the crystal lattice.

Summary - Tetrahedral vs Octahedral Voids

Voids are empty spaces present in crystal systems that arise due to the different arrangements of atoms. There are two main types of voids named as tetrahedral voids and octahedral voids. The difference between tetrahedral and octahedral void is that tetrahedral voids are visible in substances having tetrahedral crystal systems whereas octahedral voids are visible in substances having octahedral crystal systems.

Reference:

- 1.Maramandansubu Follow. "Voids in crystals." LinkedIn SlideShare, 16 June 2013. [Available here](#)
- 2."Tetrahedral Void and Octahedral Void." StudyLayer.com, 12 Mar. 2016. [Available here](#)

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APA: Difference Between Tetrahedral and Octahedral Voids.(2018 January 17). Retrieved (date), from <http://differencebetween.com/difference-between-tetrahedral-and-vs-octahedral-voids/>

MLA: "Difference Between Tetrahedral and Octahedral Voids" Difference Between.Com. 17 January 2018. Web.

Chicago: "Difference Between Tetrahedral and Octahedral Voids." Difference Between.Com. <http://differencebetween.com/difference-between-tetrahedral-and-vs-octahedral-voids/> accessed (accessed [date]).



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