Some other unique properties that sets perovskites apart and makes them ideal for technological applications include: it is the only crystal structure that is ferroelectric (spontaneous alignment of the electric dipoles caused by interactions between them) not because of an external magnetic field but due to its crystal structure, its ferro-, pyro-, and piezo-electric properties, and structural properties such as durability and chemical flexibility.

References

3. [http://wikis.lib.ncsu.edu/index.php/Perovskite](http://wikis.lib.ncsu.edu/index.php/Perovskite)
8. Professor Kim, Professor in the CHMS department at UC Davis

Outside Links


Animation of the structure of Perovskite:

[http://www.youtube.com/watch?v=Qt6B3...eature=related](http://www.youtube.com/watch?v=Qt6B3...eature=related)

Important Questions

Q: What are some properties that make the perovskite structure unique?

A: Ferro- and Piezo-electric properties, and high oxygen ion vacancy tolerance.

Q: List 2-3 modern applications of the perovskite structure.

A: SOFCs, RAM devices and HTSCs.
Q: Why are perovskite type materials especially useful in SOFCs (solid oxide fuel cells)?

A: High tolerance for oxygen ion deficiencies raises conductivity.

Q: What is the difference between cubic and orthorhombic perovskite?

A: The dimensions of the orthorhombic unit cell are unequal.

Q: Given that perovskites in an orthorhombic configuration have lattice constants of roughly $a=5.4338$, $b=5.4886$, and $c=7.6841$ angstroms(A), and using the figures above, determine the density. Each calcium ion is located at the center of the octahedra and has 12-fold coordination with the oxygen, and the titanium ions are located at the corners and has six-fold coordination with oxygen.

A: The orthorhombic configuration, which is the most common configuration in perovskite materials, has lattice constants of $a=5.4338$, $b=5.4886$, and $c=7.6841$ angstroms. One orthorhombic unit cell contains four A’s, which are the calciums for example, four B’s and 12 O’s. For the case of CaTiO$_3$, using the lattice constants and the number of atoms per cell listed previously, the density of orthorhombic CaTiO$_3$ is $3.944\text{ g/cm}^3$. A sample calculation is provided below.

\[
\text{Volume(cell)} = 5.4338\times5.4886\times7.6841 = 229.17\text{ A}^3 = 2.292\times10^{-22}\text{ cm}^3
\]

\[
\text{Mass(cell)} = 4\times\text{MW(Ca)}+4\times\text{MW(Ti)}+12\times\text{MW(O)} = 542.92\text{ g/mol} = 9.0322\times10^{-22}\text{ g/}\#
\]

\[
\text{Mass/Volume}=\text{Density}=3.944\text{ g/cm}^3
\]

Contributors

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