

A note must definitely be made about the high-critical temperature cuprates. Before we continue, let us realize that the present maximum of 139°K for the mercury-based cuprate $Hg_{0.2}Tl_{0.8}Ca_2Ba_2Cu_3O$ discovered in 1995. This is indeed very high if compared to the critical temperatures discovered during the humble beginnings of superconductivity, $\sim 4^\circ K$. many of these superconductors are very anisotropic in their crystal structures, with chains and layers. It was a complete surprise at that time when cuprates with high- T_c since most of the effort was spent on the research of high- T_c on niobium compounds. After the initial discovery of high-temperature superconductivity in a La-Ba-Cu-O system, a cuprate. The exact material was a 2-1-4 compound $La_{2-x}Ba_xCuO_4$. It is a layered perovskite, and an ordinary perovskite structure is [Figure 1]:

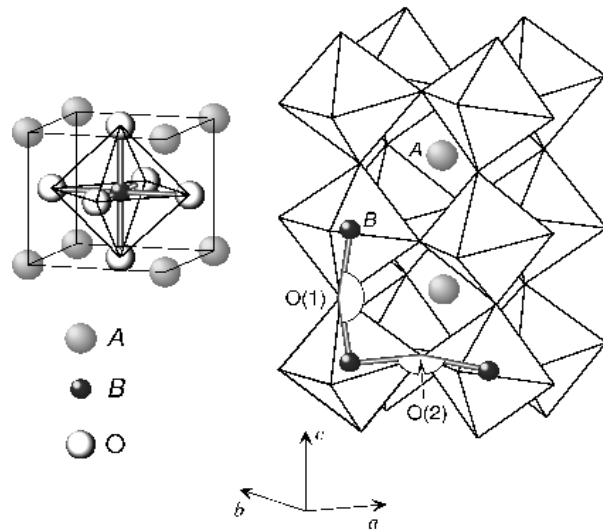
There are also other classes of high-temperature cuprates. For example, the 1-2-3 compounds $Y_1Ba_2Cu_3O_7$, the Bi-Sr-Cu-O compounds, the Bi-Sr-Ca-Cu-O compounds and the Tl-Ba-Ca-Cu-O compounds.

A few notes must be made of these high-temperature cuprates. The coherence length is very short, $\sim 10^{-7} cm$, and due to this fact the critical current densities remain rather low, since the impurity grains act like miniature Josephson junctions and weakening the current.

There are many applications of superconductivity. A list of them is shown below:

- Magnetic levitation. This concept has already been applied to the MAGLEV trains in operation in France and Japan, for example.
- Due to the fact that superconductors suffer very little energy losses so as long as the currents they are carrying does not exceed the critical current density, they are ideal for the construction of power distribution grids
- An interesting application of superconductivity would be energy storage. Since superconductors do not suffer any energy losses when carrying a current below the threshold value, they can be used to store currents by producing a magnetic field
- MRI - Magnetic Resonance Imaging. Superconductors have actually already been used for the generation of magnetic fields used in this non-invasive form of tomography
- A very obvious application of superconductivity would be the generation of powerful magnetic fields for the acceleration of particles for use in experimental particle physics. It would not be feasible to utilize conventional conductors to generate magnetic fields of comparable strength, due to power losses, excess heat generation, and the power bill, among others.

Crystal Structure of ABO_3



Perovskite