Introduction to Materials Science and Engineering
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Lecture - 33
CsCl

Let us now look at another ionic compound cesium chloride. This is also a very important structure and many compounds, many equi atomic compounds have this structure.

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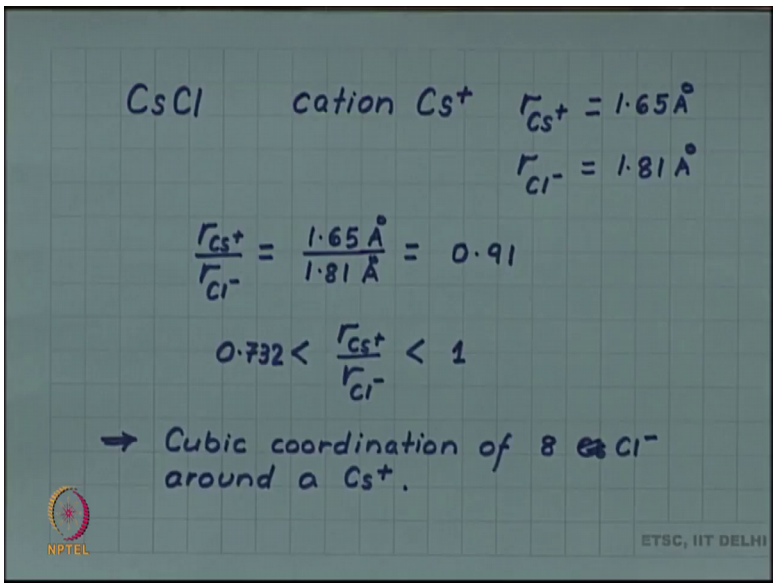

So, let us look at cesium chloride. The cation here is cesium plus within the radius of 1.65 angstrom and anion is the chloride anion 1.81 angstrom. So, the radius ratio works out to be 0.91 this radius ratio if you look at your radius ratio table fits in between 0.732 and 1, and this ratio predicts a cubic coordination of 8 chloride ions around a cesium ion.

Now, it is possible to have 8 chloride ions around the cesium ion if we have a cubic unit cell with chlorides sitting, chloride sitting at the corners of the cube at each corner at each of the 8 corners of the cube place a chloride, but in the center place, in the cube center place cesium ion.

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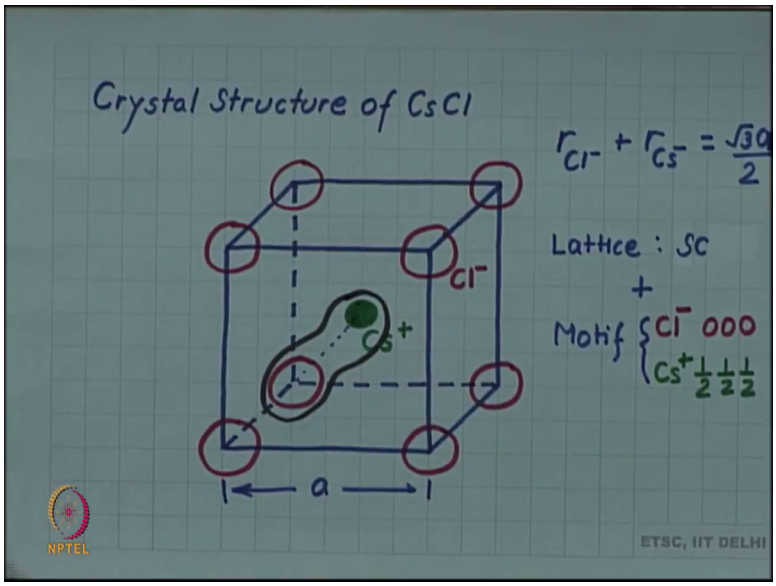

These are chloride ions and this is the cesium ion again. The nearest neighbor nearest neighbor distance is along the body diagonal and these two will be touching. So, this is a spaced out view where the ions are shown to be separated, but actually this chloride ion and this cesium ion will be in contact or will be touching.

So, we can find a relationship between the radius and the lattice parameter. So, the radius of chloride ion plus the radius of cesium ion should be equal to half the body diagonal since the full length of the body diagonal is root 3 a, we get root 3 a by 2. Also if we want to describe the crystal structure in terms of lattice and motif you can see that the lattice is actually simple cubic because only the cube corners are equivalent locations. Although there is an atom in the body center this is not equivalent to the corner atom. So, this will not be a body centered cubic lattice.

So, the lattice, the lattice is simple cubic plus the motif will be a 2 atom motif. A chloride ion at the lattice point ooo and a cesium ion at the body center of the cube and that location is described by half half half. So, the motif is a pair of atom of cesium and chlorine.

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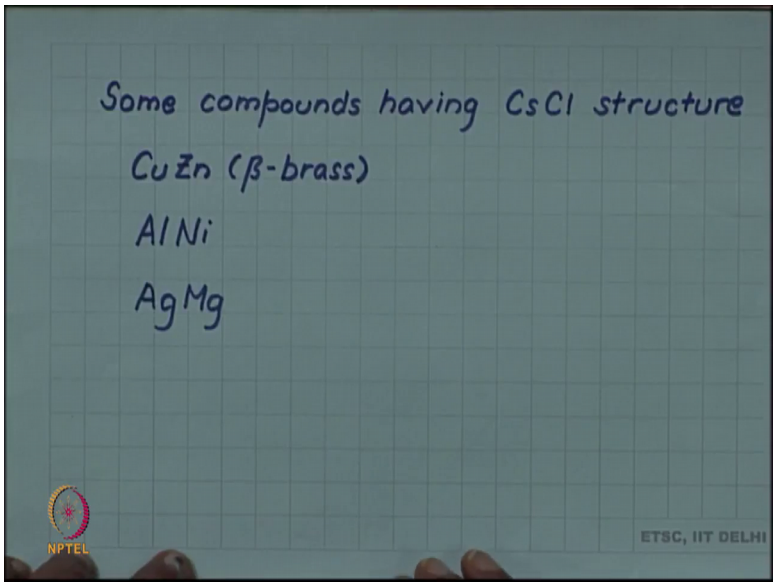

Again cesium chloride is a prototype structure any a b compound which has a structure like this where one element or one iron is sitting at the corners and other one is sitting at the body center of a cube that will be called a cesium chloride structure.

So, some examples are here. Some, all of these are inter metallic compounds. So, copper zinc which is actually a beta brass is a aluminum nickel, silver magnesium, all these form cesium chloride structure.