Introduction to Materials Science and Engineering
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Lecture – 65
Ball bearing model

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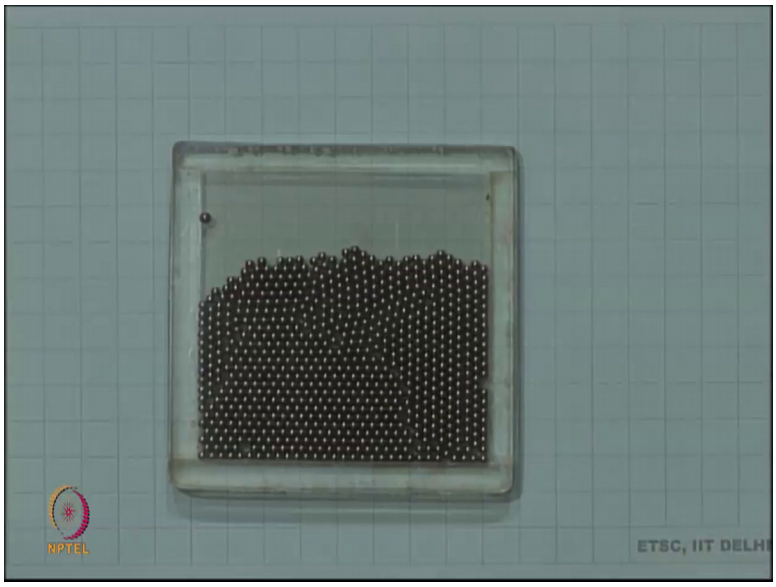

I would like to show you nice simple model to see grain boundaries and some other defects in crystal. So, these are ball bearings ordinary ball bearings, maybe your cycle ball bearings were placed between two glass plates. So, if you can arrange two glass plates in which the ball bearings can move you have a nice model a two dimensional model of a crystal which will show you the grain boundaries and some other defects.

So, if I take this model and shake it then you can see I have some, something like fluid and then if I tap it I can give it into different configurations, I can bring it into different configurations. You see now I have brought it into a single crystal. So, all atoms and all are in a nice periodic arrangement and there seem to be no defect other than the free surface which is on the top of the crystal.

But now if I again give a shape to create a different configuration you can see now, you can see now that I have created two grains we have got two grains now, one on this side and another on this side with a boundary running in between. You can see that this side grains you can see parallel, vertical planes and on this side there are horizontal. What

really has happened that this grain the a row of close packed atoms or a close packed ball bearings have aligned with the vertical side of the vertical edge of the model then whereas, this grain it has aligned with the horizontal edge of the model.

So, then you have because there is orientation difference between this and this they cannot match perfectly in between so you have a grain boundary. You can have, you can see that the sometimes a missing atom can also be left.

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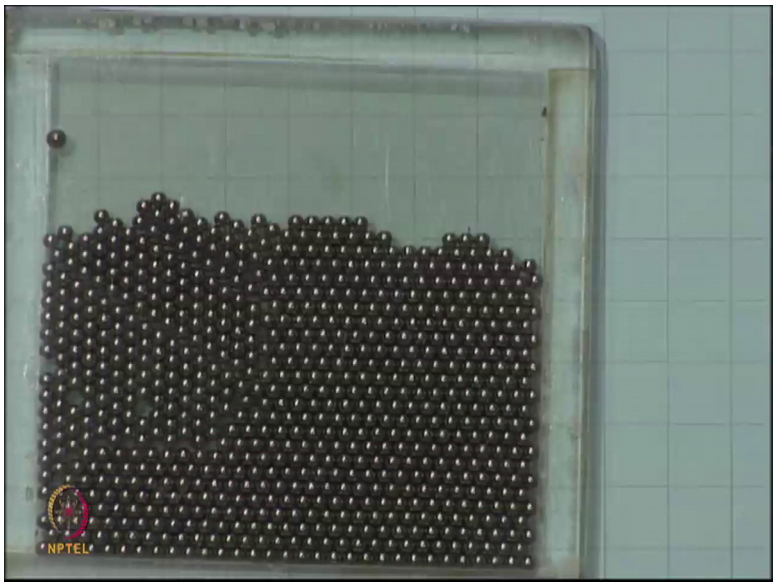

There is a missing atom here so that represents vacancy.