Introduction to Materials Science and Engineering
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Lecture – 46
Edge dislocation: Slip

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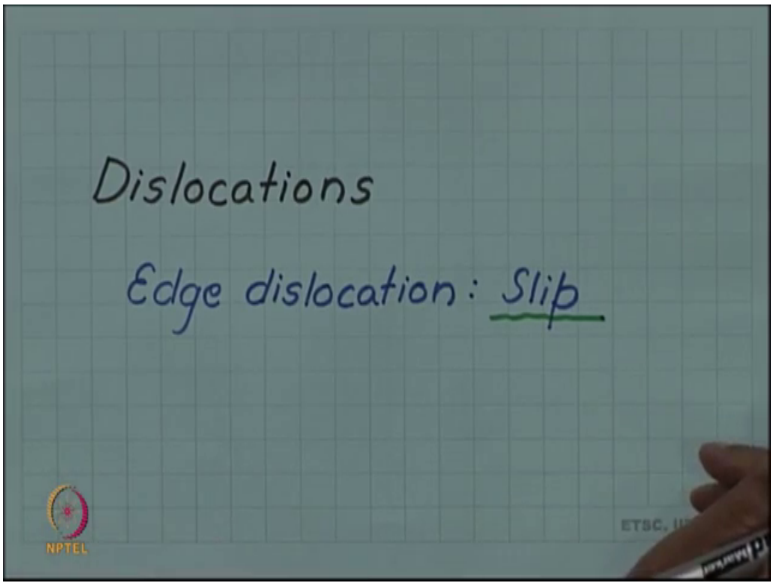

So, we have looked at dislocation, edge dislocation in particularly in the last video and we looked at it as bottom edge of the extra half plane, that is one way of looking at edge dislocation. There is another way of looking at dislocations in general and that is the slip approach. So, we will look at the slip approach of the edge dislocation in this video.

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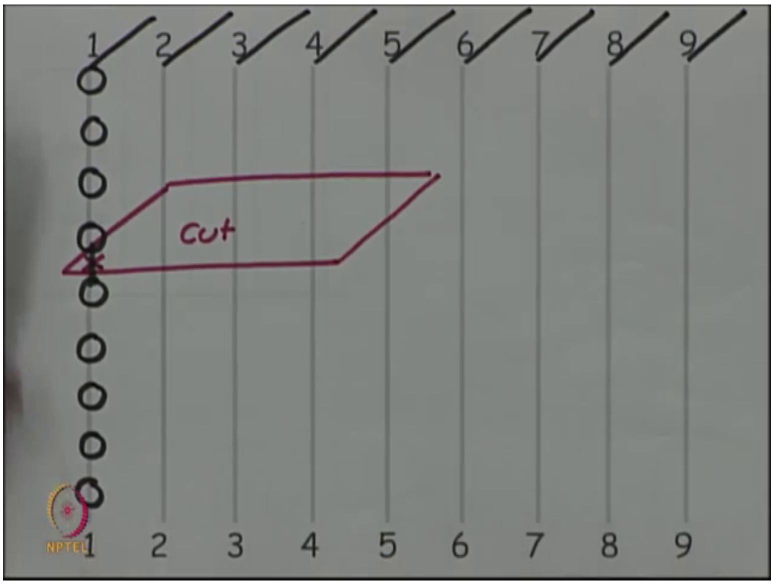

So, let us now think of these planes 1 2 3 to 9, as the 9 planes the front face of representing the front face of a simple cubic crystal. So, I could have drawn atoms I am just being lazy not to draw all the atoms, but you can imagine that this is an atomic plane.

So, for one plane let me draw this here. So, and these planes like in the my previous drawing I am going into the crystal. So, you can imagine a three dimensional crystal of which you are seeing the front face. Now, what I want to do is to make a cut and I make a cut on the first 4 planes. So, then my cut is also in 3 dimensions. So, across this plane I cut all the bonds. So, for example, this bond this one of the atom was above the plane the another was below the plane this bond is cut by plane which I have introduced.

So, for all these atoms across this plane the bonds are broken. So, this is what is meant by this cut. So, if there was any bond going through this plane that that bond is cut.

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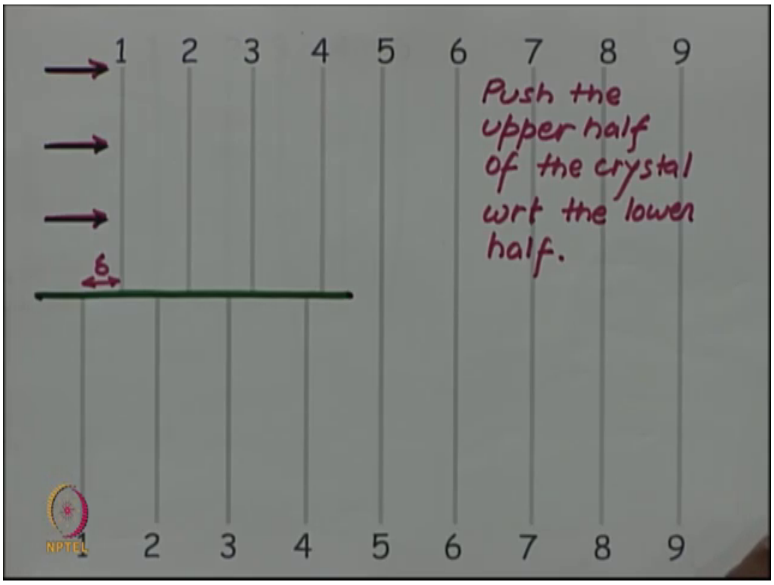

Now, if I do that and then try to push since I have made a cut I can try to push. So, these arrows are showing the push direction. So, I am pushing the upper half of the crystal with respect to the lower half across this plane, push the upper half of the crystal with respect to the lower half, half.

So, now, you can see that the upper part of the plane one previously the plane one was continuous, but now upper half of the plane has moved by some small amount let us say delta towards the plane two. But the plane the upper half of the plane two has also moved towards plane 3 and so on. But then upper half of the plane 4 also moves inwards towards 5, but remember that my cut was only up to 4 planes, my cut plane stopped after the 4th plane I had not cut the entire crystal into 2 halves I had run my knife only up to 4th plane. So, the 4th plane also the top half of the 4th plane also shift towards 5, but then beyond 5, 5 and beyond further down I do not have any shift like this because there was no cut the cut was not extending beyond this.

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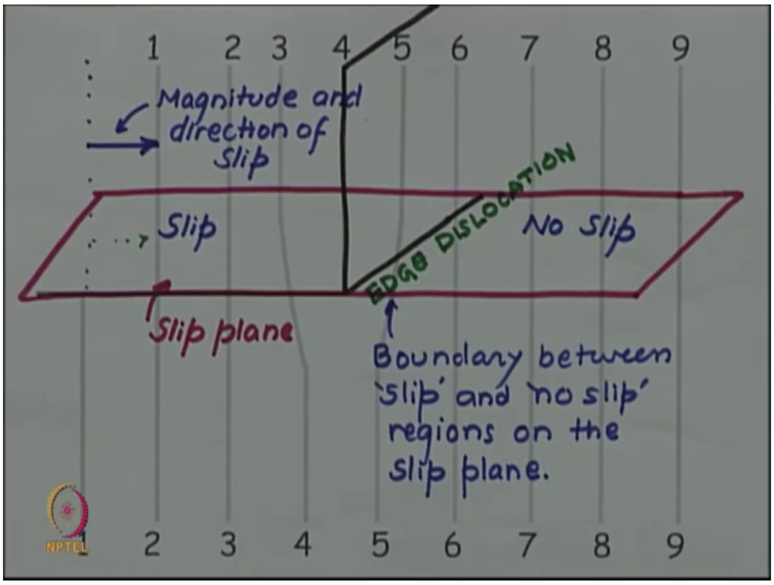

So, if I continue this push so much so, that the plane 1 now joins the top half of the plane 1 now joins with plane 2. So, I have drawn that now as a straight plane here only the identity on the top is 1, but on the bottom is 2. So, you can think of this as a plane which was here plane which was here has now moved all the way to join with the bottom half of 2, the top up half of 2 has joined with the bottom half of 3.

The 3 has joined with 4, 4 the top half of the 4 has left has been left hanging because the 5th plane is not available for joining this plane I had not cut. So, from plane 5 onwards they were not cut and there was no displacement. So, this 4th plane the last plane of my cut is left hanging. So, you can now see that this plane will app like the extra half plane discussed in the previous video. So, this plane becomes an extra half plane.

So, the bottom edge of this obviously, will become the dislocation line, it is like in the previous video this becomes the edge dislocation line. And if I complete my plane, so let me complete my horizontal plane of the cut of course, I have not cut on the right hand side, but I am drawing the plane continuously and I will mark the left hand side as the slip side and on the right hand side as the no slip side because remember I had not cut on this right side of the plane. So, on the slip side I made a cut and every plane was made to slip by an amount equal to the inter planar spacing. So, this is the magnitude and direction of slip.

So, I have and this plane the red plane I will give a name slip plane. So, you can see that the same extra half plane and the bottom edge of the extra half plane has been created now. So, I have created an edge dislocation, but I have created by this imaginary experiment of cutting the crystal and making this slip and in this ah, in this thought experiment the edge dislocation now appears to be as the boundary between slipped and un slipped region. So, this edge dislocation is the boundary between slip and no slip regions on the slip plane.

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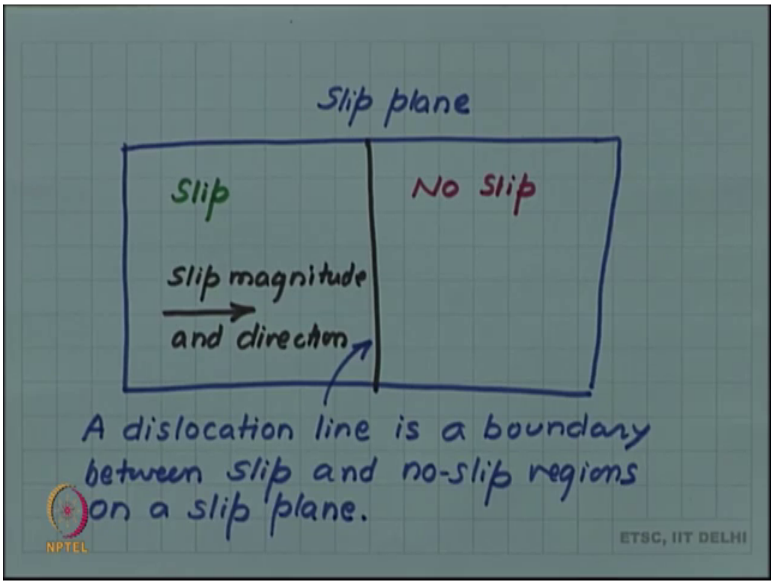

And we will find that this is a more general way of defining a dislocation that is if I just draw, if I think of a plane in a crystal you can think of this as the plane in a crystal and if I have a line in that crystal which divides that plane. So, this plane I am calling as slip plane and the slip plane is divided into 2 sides by a line such that on one side you have a slip region slip side and the other side you have no slip. Then the boundary between the slip and no slip region will be a dislocation line.

This is a general slip definition. So, we can say a dislocation line and we can show the magnitude and direction of the slip. So, in this case we had seen that the slip was like this, slip magnitude and direction. And you should remember that this, this plane which I have drawn this rectangular plane the crystal is both above and below this plane, and when I say slip the crystal above this plane is slipping with respect to the crystal below this plane. But this slip is happening only on the left hand side of this line and not on the right hand side. So, that is why the left side of the slip plane is called the slip side and the right hand side as no slip side.

And a general definition of dislocation can be given that a dislocation line is a boundary between slip and no slip regions on a slip plane.

So, thank you. We will continue the discussion of dislocation in for quite some time now we will go into the dislocation approach development and we will discuss other types of dislocations, and we will discuss a vectors associated to characterize the dislocation that is the burgess vector and the line vector and so on.