Introduction to Materials Science and Engineering
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Lecture – 113
CRSS: Theory Vs experiment

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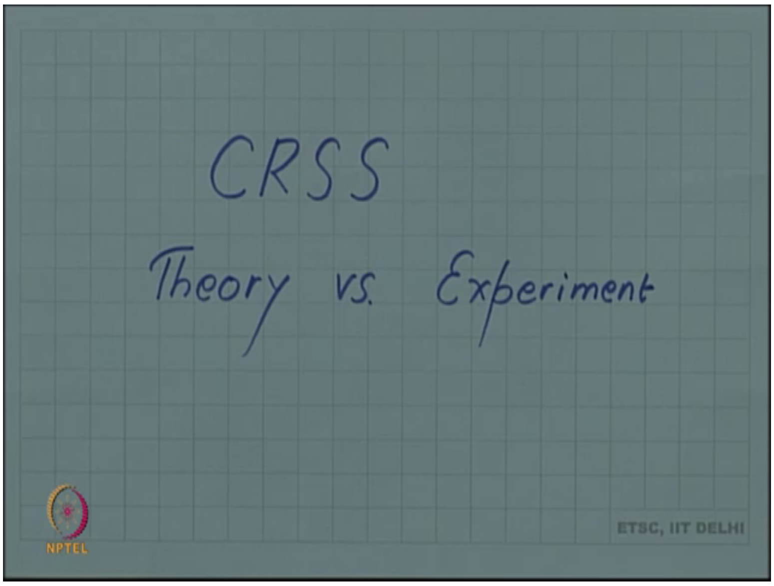

So, in this video let us compare those theoretical values obtained by that that kind of calculations with experimental values which were also available.

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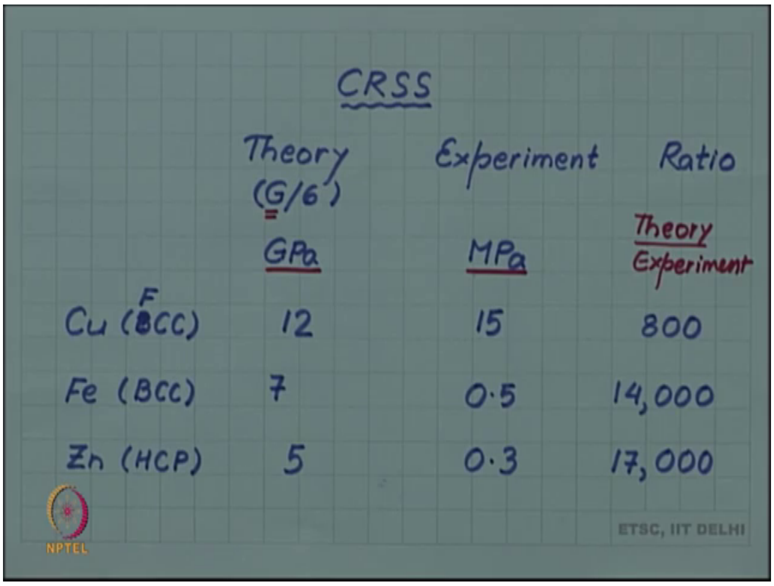

So, as we saw that the critical resolved shear stress was an important parameter it was established as an important parameter. Because this was independent oh for a single crystal the value of critical resolved shear stress was independent of the orientation of a stress axis this is the content of Schmid's law. And whereas, the yield stress was orientation dependent

So, people started taking interest in the values of critical resolved shear stress and then a theoretical estimate was proposed which was G by 6 which is simply G is the shear modulus. So, shear modulus divided by 6, was suppose to be the theoretical value of critical resolved shear stress.

If we use the experimental value non experimental this is a very simple the theory umm predicted a very simple way of calculating critical resolved shear stress and so all we need to know now is the shear modulus of different material. And these have been experimentally determined.

So, if we divide the shear modulus by 6 we get different values of critical resolved shear stress for different materials, 3 materials I have stated here. And some typical value of modulus divided by 6 which will be the critical resolved shear stress predicted for them; however, when you compare this with theory there is a startling mismatch.

So, you can see the experimental value now first of all look at the units the theoretical values are being given in Giga Pascal whereas, the experimental values are being written in Mega Pascal's. So, there is an enormous difference between the theoretically predicted value and experimentally measured value in particular the experimental values are much lower.

So, if we take the ratio; ratio of the theoretical value by the experimental value. Then we get values like 18,000, 14000, and 17,000 which means copper is 800 times weaker real crystal of copper is 800 times weaker than what the theory is predicting for it. Iron is 14000 times weaker than its theoretical prediction and zinc 17000 times.

So, it is not like a little disagreement between theory and experiment there is a huge gap huge gap between theory and experiment. So, this was a big mystery a big problem from 90 years ago when people were worrying about this and calculating these values.

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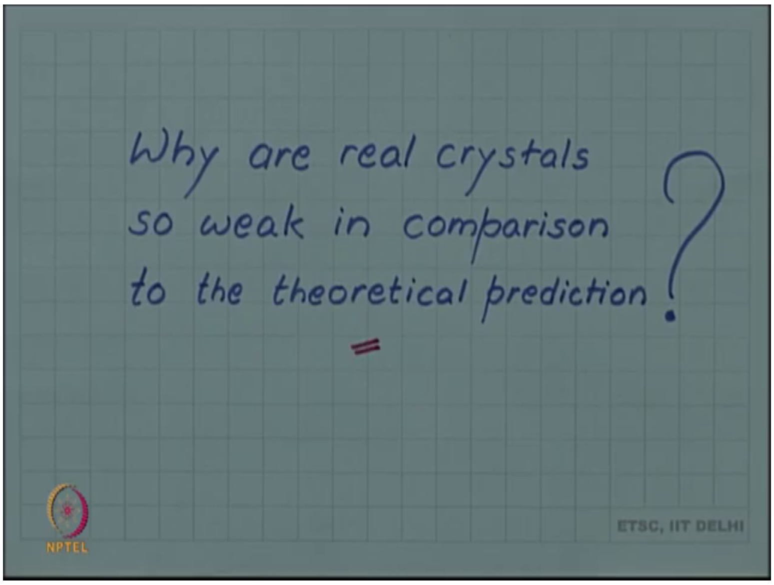

So, this question why are real crystals so weak in compared to theoretical theoretically predicted values? This was a big question. And we will look at how this problem was actually solved.