**Introduction to Materials Science and Engineering**
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**Lecture - 132**
**Effect of stress and temperature on creep**

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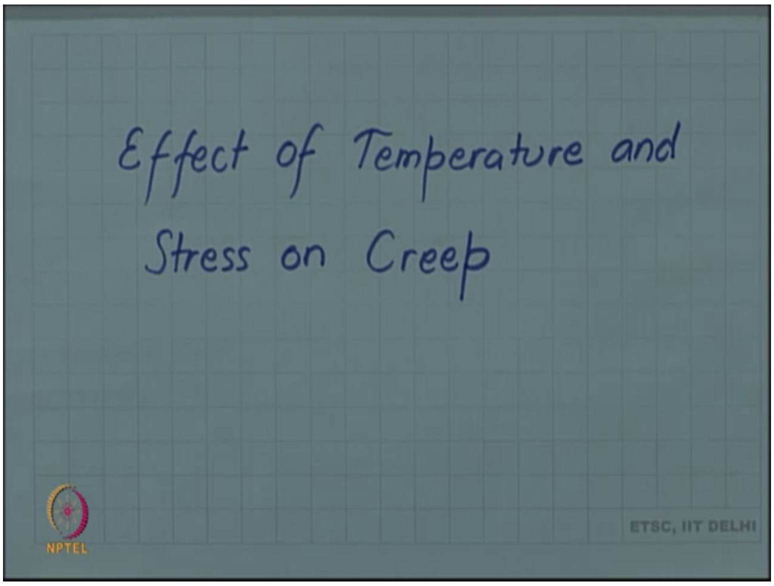


Let us discuss the Effect of temperature and stress on creep.

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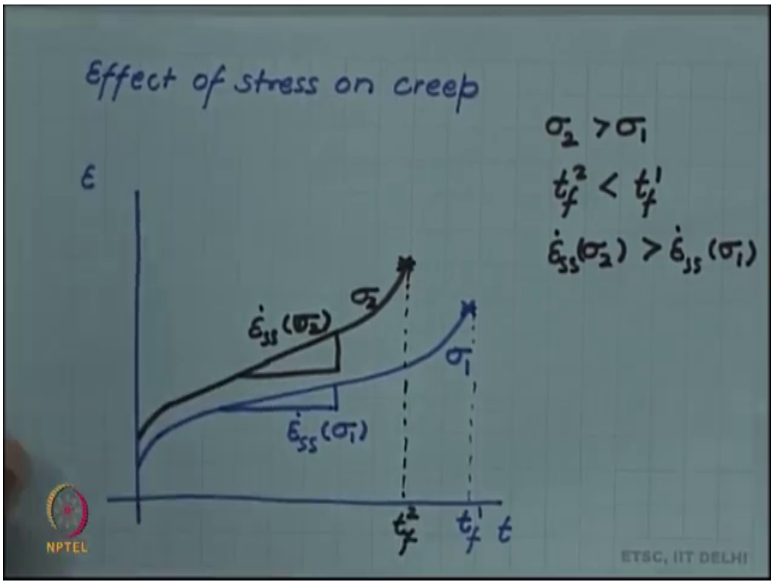

So, effect of stress on creep is similar to the effect of temperature. So, if this stress is suppose done at stress sigma 1 and if we now conduct a stress at another stress at another stress sigma 2 greater than sigma 1, then the initial strain will be more, at the same time the steady state creep rate will be higher and finally, the creep life will be shorter.

So, if we have let us say a creep life of t f 1 at sigma 1, then the creep life t f 2 at sigma 2 is shorter, t f 2 is shorter than t f 1, but the steady state strain rate which is the slope in the steady state regime epsilon steady state at sigma 1, this is less with increased stress the slope increases, this is steady state strain rate at sigma 2.

So, steady state strain rate at sigma 2 is greater than strain greater sigma 1. This stress dependence and the temperature dependence can be given as an equation.

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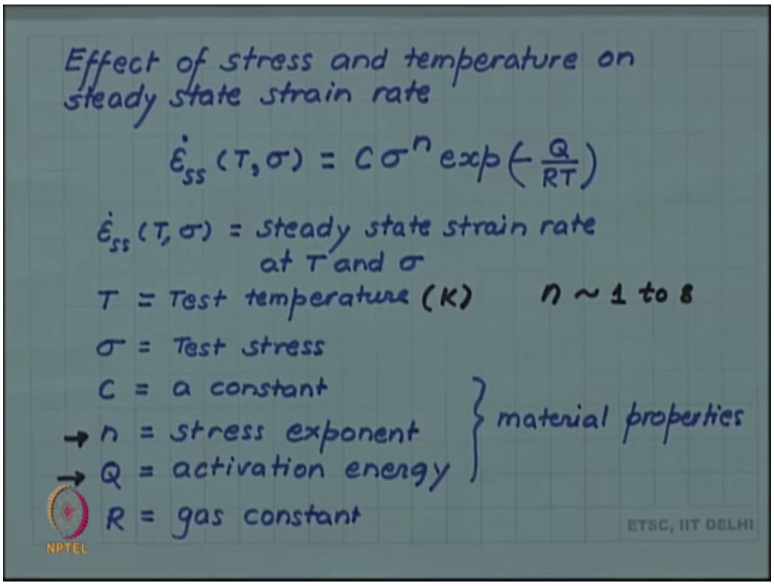


So, here is the equation. Steady state strain rate depends on the stress and temperature. The temperature dependence is the familiar exponential dependence, you can see here exponential minus Q by R T where T is the test temperature in Kelvin of course, in these equations it is always in the Kelvin. Q is the activation energy. So, this will be the activation energy for creep and R is the gas constant.

So, exponential dependence on temperature; the stress dependence is like a power law. So, its stress to the power n; n is called the stress exponent. So, it is some power of stress; n generally varies from 1 to 8. So, you can write it here; n is 1 to 8 depending upon the different creep mechanisms which we are going to discuss.

So, the creep rate steady state creep rate is a strong function both of stress and temperature. So, a slight increase in stress and a slight increase in temperature can significantly enhance the steady state creep rate and thus dramatically you can reduce the creep life. So, creep is a very stress and temperature sensitive process.