UNIT - V

MECHANICAL PROPERTIES AND DEFORMATION MECHANISM

5.5 FATIGUE TEST :

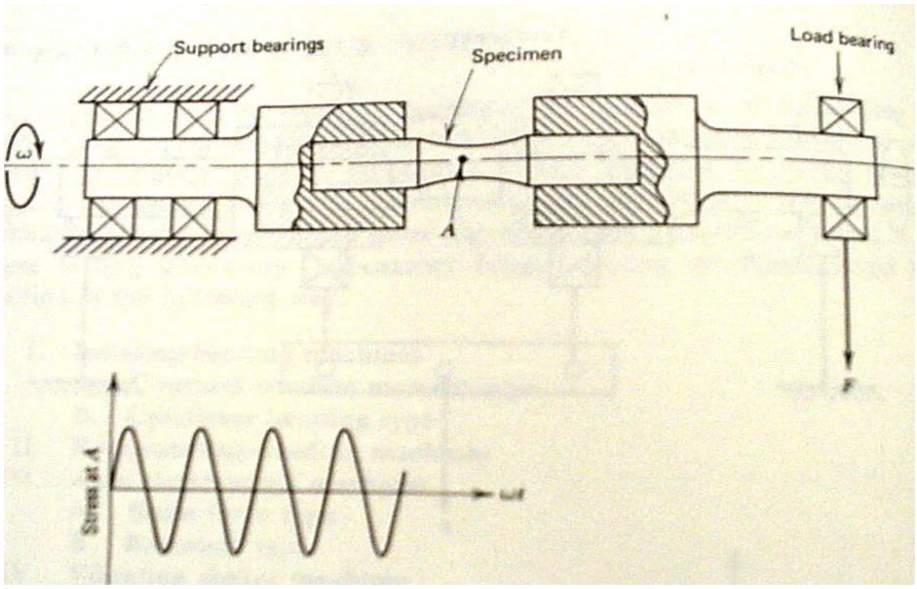

Fig 5.20 Rotating beam fatigue testing machine

When a material is subjected to repeated stress, it fails at stress below the yield point, stresses , such type of failure of a material is known as fatigue.

The capacity of material to with stand repeatly applied stresses.

An electric motor capable of running at 10,000 rpm

A large bearing whose purpose is to relieve the motor from the large bending moment which is applied to the specimen

Collect chucks to hold the specimen

Revolution counter to count the number of revolution.

A rotating lever arms which is subjected to a downward force in order to give bending moment to the specimen.

The specimen is in the form of a cantilever and loaded at one end through a ball bearing.

The upper surface of the specimen is under tension and lower surface of the specimen is under compression.

5.5.1 S-N CURVE :

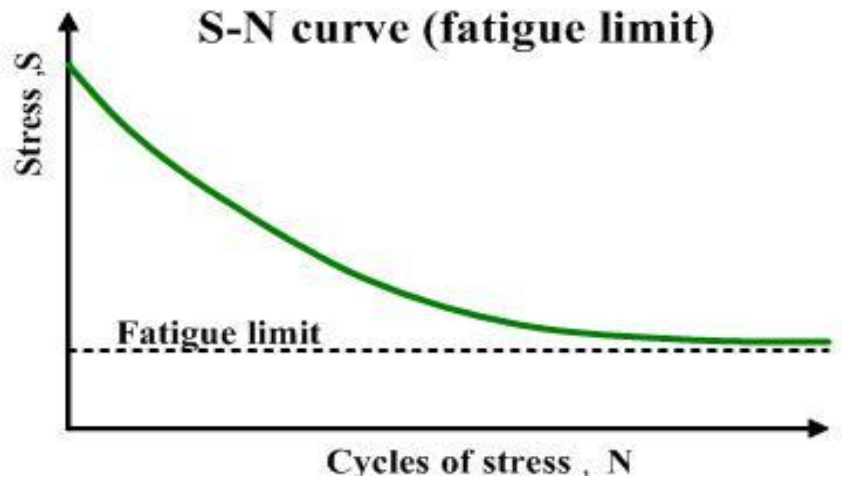

Fig 5.21 S-N Curve

where,

S → Stresses

N → Number of revolutions

Several specimens are tested one by one above, at gradually decreasing stress levels. The number of cycles to failure in each is noted. The results are presented as a graph, with the stress level (S) plotted versus the number of cycles to failure. Such as plot is known as S-N curve.

Two important information are obtained from S-N curve :

Endurance limit

Fatigue life

i) Endurance limit:

It is defined as the maximum stress that can be applied repeatedly for infinite number of times without failure of the material.

ii) Fatigue life:

It tells how long a component survives at a particular stress level.

5.6 CREEP TEST :

The continuous deformations of a metal under a steady load is known as creep. When a material is subjected to static loads at higher temperatures for a long period, the materials deforms under stresses well below the yield strength.

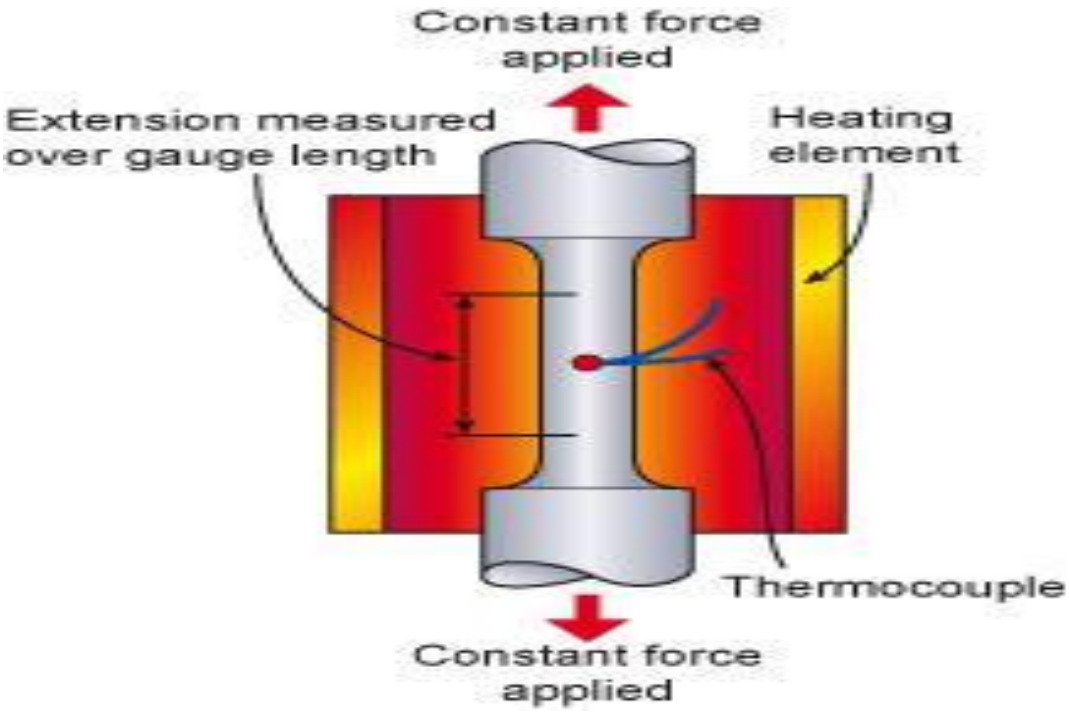

Fig 5.22 Creep test

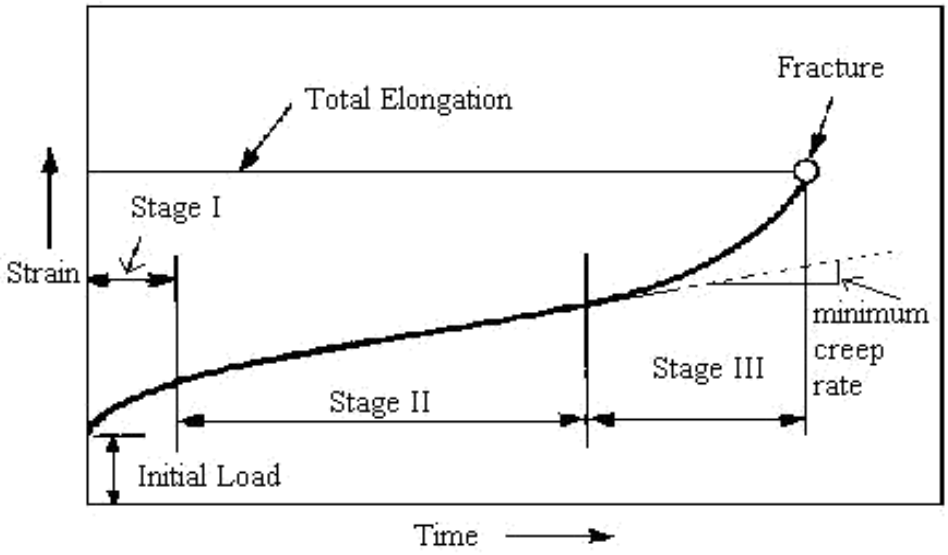

Fig 5.23 Creep curve

The specimen is subjected to a constant load by means of dead weights and levers. A tubular, electrically heated furnace surrounds the specimen. The ends of the specimen are sometimes fitted with thermo couple for the measurement of temperature or to maintain a constant temperature. The total creep or percentage elongation can be measured by an extensometer and the percentage elongation is plotted against time for the entire duration of the test.

Primary creep:

In this stage the creep is mainly due to dislocation movement the creep rate decreases with time.

Secondary creep :

During this stage, the rate of work hardening and recovery are equal. So the material creep at steady rate.

Tertiary creep :

In this stage, creep rate increases with time until fracture occurs. Generally the tertiary creep occurs due to necking of the specimen or grain boundary sliding .Creep curve is plotted between strain and time in hours.

Factors affecting creep :

Grain size

Thermal stability of micro structure

Chemical reaction

Prior strain.