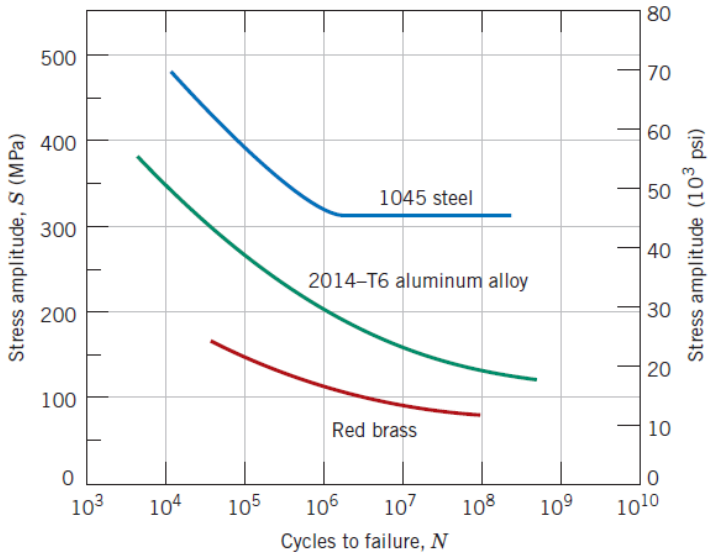
Chapter 8 – Failure II (Fatigue and Creep)

1. A cylindrical 1045 steel bar is subjected to repeated compression-tension stress cycling along its axis. If the load amplitude is 66700 N , compute the minimum allowable bar diameter to ensure that fatigue failure will not occur.

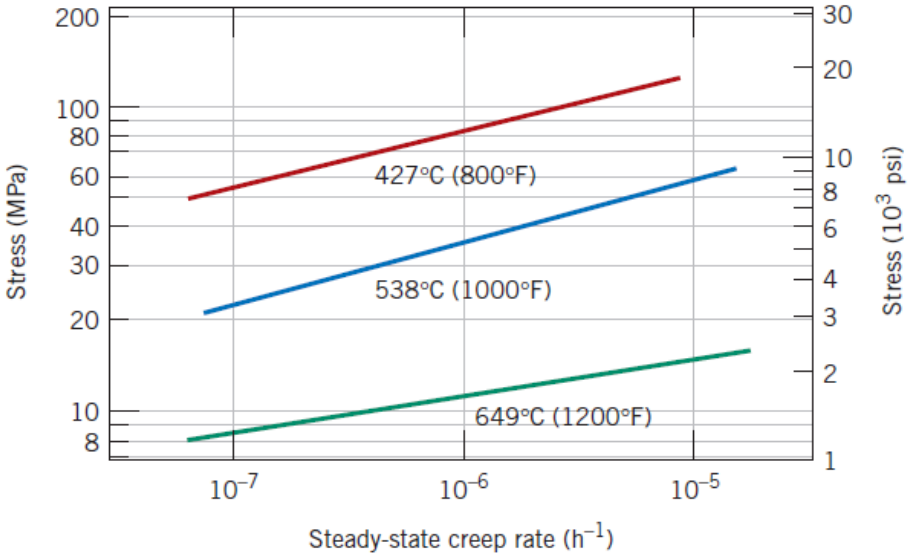


2. A 6.4 mm diameter cylindrical rod fabricated from a 2014-T6 aluminum alloy is subjected to a reversed tension-compression load cycling along its axis. If the maximum tensile and compressive loads are 5340 N and -5340 N, respectively, determine its fatigue life. Assume the stress plotted in figure is stress amplitude.

3. Briefly explain the difference between fatigue striations and beach marks both in terms of (a) size, (b) origin.

4. List four measure that may be taken to increase the resistance to fatigue of a metal alloy.

5. A specimen 1015 mm long of a low carbon-nickel alloy is to be exposed to a tensile stress of 70 MPa at 427 °C. Determine its elongation after 10000 h. assume that the total of both instantaneous and primary creep elongations is 1.3 mm.



6. Estimate the activation energy for creep for the low carbon-nickel alloy having the steady-state creep behavior shown in figure. Use data taken at a stress level of 55 MPa and temperatures of 427°C and 538°C. Assume that the stress exponent n is independent of temperature. (b) Estimate creep rate at 649°C.

7. Briefly explain why BCC and HCP metal alloys may experience a ductile to brittle transition with decreasing temperature, whereas FCC alloys do not experience such a transition.