

MATSE 259
Classwork #6

1. What is the magnitude of the maximum stress that exists at the tip of an internal crack having a radius of curvature of 2.5×10^{-4} mm and a crack length of 2.5×10^{-2} mm when a tensile stress of 170 MPa is applied?
2. A fatigue test was conducted in which the mean stress was 50 MPa and the stress amplitude was 225 MPa.
 - (a) Compute the maximum and minimum stress levels.
 - (b) Compute the stress ratio.
 - (c) Compute the magnitude of the stress range.

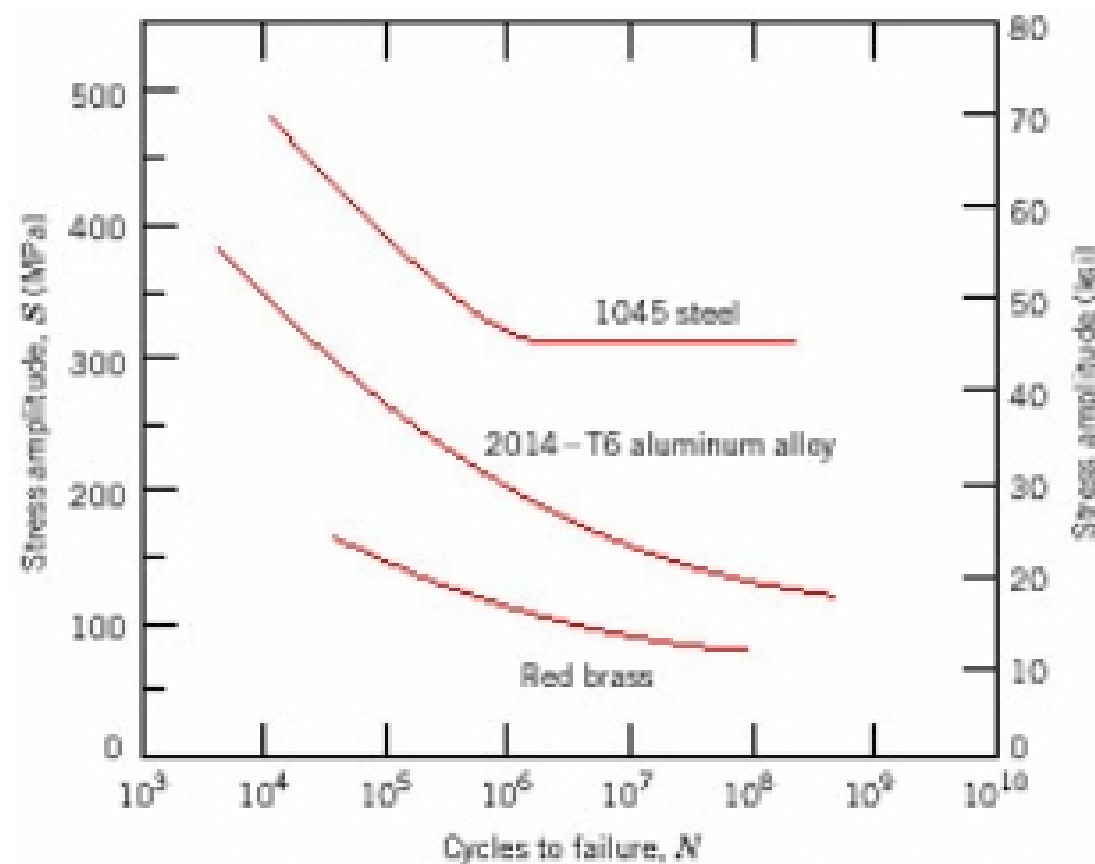


FIGURE 8.42 Stress magnitude S versus the logarithm of the number N of cycles to fatigue failure for red brass, an aluminum alloy, and a plain carbon steel. (Adapted from H. W. Hayden, W. G. Moffatt, and J. Wulff, *The Structure and Properties of Materials*, Vol. III, *Mechanical Behavior*, p. 15. Copyright © 1965 by John Wiley & Sons, New York. Reprinted by permission of John Wiley & Sons, Inc. Also adapted from *ASM Handbook*, Vol. 2, *Properties and Selection: Nonferrous Alloys and Special-Purpose Materials*, 1990. Reprinted by permission of ASM International.)

3. An 8.0 mm diameter cylindrical rod fabricated from a red brass alloy (Figure 8.42) is subjected to reversed tension-compression load cycling along its axis. If the maximum tensile and compressive loads are +7500 N and -7500 N, respectively, determine its fatigue life.

4. Three identical fatigue specimens (denoted A, B, and C) are fabricated from a nonferrous alloy. Each is subjected to one of the maximum-minimum stress cycles listed below; the frequency is the same for all three tests.

Specimen	σ_{\max} (MPa)	σ_{\min} (MPa)
A	+450	-350
B	+400	-300
C	+340	-340

- (a) Rank the fatigue lifetimes of these three specimens from the longest to the shortest.
- (b) Now justify this ranking using a schematic S-N plot.

5. Superimpose on the same strain-versus-time plot the schematic creep curves for both constant tensile stress and constant load, and explain the difference in behavior.