

Polymer-Matrix Composites

16.21 (a) This portion of the problem calls for us to calculate the specific longitudinal strengths of glass-fiber, carbon-fiber, and aramid-fiber reinforced epoxy composites, and then to compare these values with the specific strengths of several metal alloys.

The longitudinal specific strength of the glass-reinforced epoxy material ($V_f = 0.60$) in Table 16.5 is just the ratio of the longitudinal tensile strength and specific gravity as

$$\frac{1020 \text{ MPa}}{2.1} = 486 \text{ MPa}$$

For the carbon-fiber reinforced epoxy

$$\frac{1240 \text{ MPa}}{1.6} = 775 \text{ MPa}$$

And, for the aramid-fiber reinforced epoxy

$$\frac{1380 \text{ MPa}}{1.4} = 986 \text{ MPa}$$

Now, for the metal alloys we use data found in Tables B.1 and B.4 in Appendix B (using the density values from Table B.1 for the specific gravities). For the cold-rolled 7-7PH stainless steel

$$\frac{1380 \text{ MPa}}{7.65} = 180 \text{ MPa}$$

For the normalized 1040 plain carbon steel, the ratio is

$$\frac{590 \text{ MPa}}{7.85} = 75 \text{ MPa}$$

For the 7075-T6 aluminum alloy

$$\frac{572 \text{ MPa}}{2.80} = 204 \text{ MPa}$$

For the C26000 brass (cold worked)