Assignment #26

16.15 *Compute the longitudinal strength of an aligned carbon fiber–epoxy matrix composite having a 0.25 volume fraction of fibers, assuming the following: (1) an average fiber diameter of* 10×10^{-3} *mm (*3.94×10^{-4} *in.), (2) an average fiber length of 5 mm (0.20 in.), (3) a fiber fracture strength of 2.5 GPa (*3.625×10^{5} *psi), (4) a fiber–matrix bond strength of 80 MPa (11,600 psi), (5) a matrix stress at composite failure of 10.0 MPa (1450 psi), and (6) a matrix tensile strength of 75 MPa (11,000 psi).*

16.18 *(a) From the moduli of elasticity data in Table 16.2 for glass fiber-reinforced polycarbonate composites, determine the value of the fiber efficiency parameter for each of 20, 30, and 40 vol% fibers.*

(b) Estimate the modulus of elasticity for 50 vol% glass fibers.

16.19 *For a polymer-matrix fiber-reinforced composite:*

(a) List three functions of the matrix phase.

(b) Compare the desired mechanical characteristics of matrix and fiber phases.

(c) Cite two reasons why there must be a strong bond between fiber and matrix at their interface.

16.D5 *It is necessary to fabricate an aligned and discontinuous glass fiber–epoxy matrix composite having a longitudinal tensile strength of 1900 MPa (275,000 psi) using a 0.45 volume fraction of fibers. Compute the required fiber fracture strength, assuming that the average fiber diameter and length are* $.8 \times 10^{-3}$ *mm (*3.1×10^{-4} *in.) and 3.5 mm (0.14 in.), respectively. The fiber–matrix bond strength is 40 MPa (5,800 psi), and the matrix stress at composite failure is 12 MPa (1740 psi).*