MSE250 - Homework 10 Textbook Questions and Tables (8th ed.)

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.

16.29 Briefly describe laminar composites. What is the prime reason for fabricating these materials?

Table B.2 Room-Temperature Modulus of Elasticity Values for Various Engineering Materials

Material	Modulus of Elasticity (GPa)
	FIBER MATERIALS
Aramid (Kevlar 49)	131
Carbon (PAN precursor)	
• Standard modulus	230
• Intermediate modulus	285
• High modulus	400
E-glass	72.5
	COMPOSITE MATERIALS
Aramid fibers–epoxy matrix ($V_f = 0.60$)	
Longitudinal	76
Transverse	5.5
High-modulus carbon fibers–epoxy matrix ($V_f = 0.60$)	
Longitudinal	220
Transverse	6.9
E-glass fibers–epoxy matrix ($V_f = 0.60$)	
Longitudinal	45
Transverse	12

Table B.4 Typical Room-Temperature Yield Strength, Tensile Strength, and Ductility (Percent Elongation) Values for Various Engineering Materials

Material/Condition	Yield Strength (MPa)	Tensile Strength (MPa)	Percent Elongation
FIBER MATERIALS			
Aramid (Kevlar 49)	—	3600–4100	2.8
Carbon (PAN precursor)			
• Standard modulus (longitudinal)	—	3800–4200	2
• Intermediate modulus (longitudinal)	—	4650–6350	1.8
• High modulus (longitudinal)	—	2500–4500	0.6
E-glass	—	3450	4.3
COMPOSITE MATERIALS			
Aramid fibers–epoxy matrix (aligned, $V_f = 0.6$)			
• Longitudinal direction	—	1380	1.8
• Transverse direction	—	30	0.5
High-modulus carbon fibers–epoxy matrix (aligned, $V_f = 0.6$)			
• Longitudinal direction	—	760	0.3
• Transverse direction	—	28	0.4
E-glass fibers–epoxy matrix (aligned, $V_f = 0.6$)			
• Longitudinal direction	—	1020	2.3
• Transverse direction	—	40	0.4