

Chapter 3 Homework: Polymer and Polymer Composite Processing

Due:

Available Points: 50

**1. What is the definition of a composite material? List and explain the two classifications of a composite. Give an example of each classification. (5 points)**

**2. Name 7 advantages of composite materials. (7 points)**

**3. Is the following material a composite? Yes or No? (9 points)**

- a. Rigid-rod polymers molecularly dispersed in PMMA
- b. Blend of two miscible polymers
- c. Phase-separated diblock copolymer
- d. Tire made of carbon black and polybutadiene
- e. Cotton fiber consolidated by phenol resin
- f. Sugar/Water mixture
- g. Mica and polyethylene powder mixture
- h. Bullet proof jacket made of liquid crystal molecule, Kevlar
- i. Consolidated two immiscible polymers

**4. True or False? Correct the false statements. (4 points)**

- a. A roving is a type of filler that is used to reduce the amount of plastic required and provides almost no reinforcement effect.
- b. Nanofillers that achieve effective dispersion are more efficient than traditional fillers at improving polymer properties.
- c. The hierarchy of reinforcing fibers from thinnest to thickest is filament < strand < roving.
- d. A polymer is considered an engineering plastic if its mechanical properties are maintained around 200°C.

**5. Give one example of a naturally occurring composite, mineral filler, and synthetic fiber. Explain the usefulness of mineral fillers and synthetic fibers for composite preparation. (4 points)**

The following list contains all the processes that could be answers to the following questions

- Injection Molding
- Transfer Molding
- Vacuum Assisted Transfer Molding
- Extrusion
- Pultrusion
- Filament Winding
- Hand Lay-Up
- Spray-Up
- Compression Molding
- Resin Transfer Molding
- Reaction Injection Molding

**6. What process does each description characterize? (7 points)**

- a. Laying down fabrics made of reinforcement fibers and then painting the matrix resin layer by layer
- b. Uses a hydraulic press to form the composite into shape
- c. The closed mold composite processing method that allows manufacturing of a very large object
- d. Fiber/resin mixture is fed into the hopper and transferred into a heated barrel, screws rotate to apply a high shear process and molten resin is pushed forward and injected with a high pressure into the mold cavity through the runner and gate
- e. A bundle of fiber rovings are passed through a wet resin bath, squeezed into a desired shape, passed through a heated die, and cured into a final composite
- f. The processing technique that offers the shortest cycle time
- g. Resin-wet rovings are wound around a mandrel, and the mandrel is cured to a solid composite

**7. Which of these processes are highly automated? Circle 3. (3 points)**

- a. Hand Lay-up
- b. Transfer Molding
- c. Pultrusion
- d. Filament Winding
- e. RIM
- f. Extrusion

**8. Which of these processes can be used for nanocomposite processing? Circle 3. (3 points)**

- a. Spray-Up
- b. Compression Molding
- c. Injection Molding
- d. Transfer Molding
- e. Extrusion
- f. Pultrusion

**9. You are asked to manufacture the following products. Choose one technique to use. (5 points)**

- a. A life size statue of yourself.
- b. An arrow used for archery.
- c. HDPE pipe (5 cm diameter, 250 m long)
- d. A high-pressure railway tank car
- e. A latest design snowmobile

Multiple Choice. Select a processing method based on each of the desired properties (3 points)

**10. The composite processing technique suitable for the highest strength composites**

- a. Compression Molding
- b. Filament Winding
- c. Pultrusion
- d. Injection Molding

**11. The processing method for the most versatile design flexibility of the mold shape using continuous fiber reinforcement**

- a. Hand-Lay Up
- b. Pultrusion
- c. Thermoforming
- d. Extrusion

**12. Best method for processing a very intricate shaped object with a thermoplastic polymer.**

- a. Compression Molding
- b. Spray-Up Molding
- c. Pultrusion
- d. Injection Molding