

Composites

A composite material can be defined as a combination of two or more materials that results in better properties than those of the individual components used alone. In contrast to metallic alloys, each material retains its separate chemical, physical, and mechanical properties. The two constituents are a reinforcement and a matrix. The main advantages of composite materials are their high strength and stiffness, combined with low density, when compared with bulk materials, allowing for a weight reduction in the finished part.

Typical Reinforced Type

The reinforcing phase provides the strength and stiffness. In most cases, the reinforcement is harder, stronger, and stiffer than the matrix. The reinforcement is usually a fiber or a particulate. Particulate composites have dimensions that are approximately equal in all directions. They may be spherical, platelets, or any other regular or irregular geometry. Particulate composites tend to be much weaker and less stiff than continuous fiber composites, but they are usually much less expensive. Particulate reinforced composites usually contain less reinforcement (up to 40 to 50 volume percent) due to processing difficulties and brittleness.

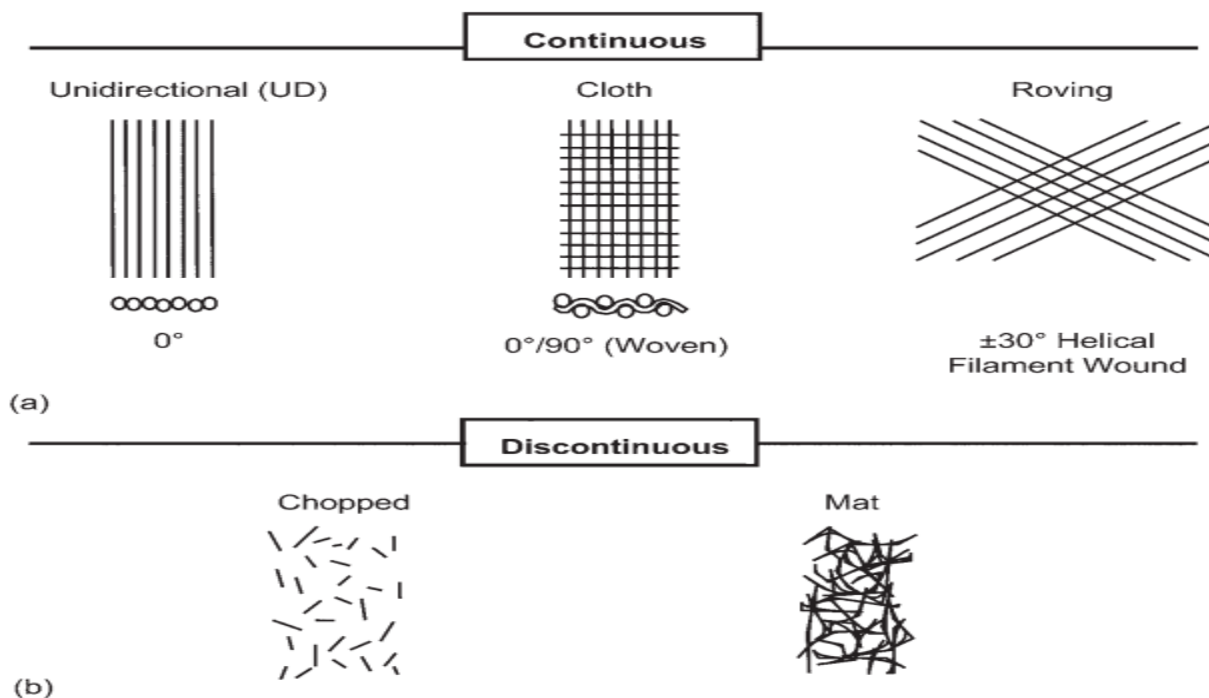


Fig. 1.1 Typical reinforcement types

Polymer Matrix Composite Fabrication Processes

The major processing routes for polymer matrix composites are shown in Fig. 1.3. Two types of polymer matrices are shown: thermosets and thermoplastics.

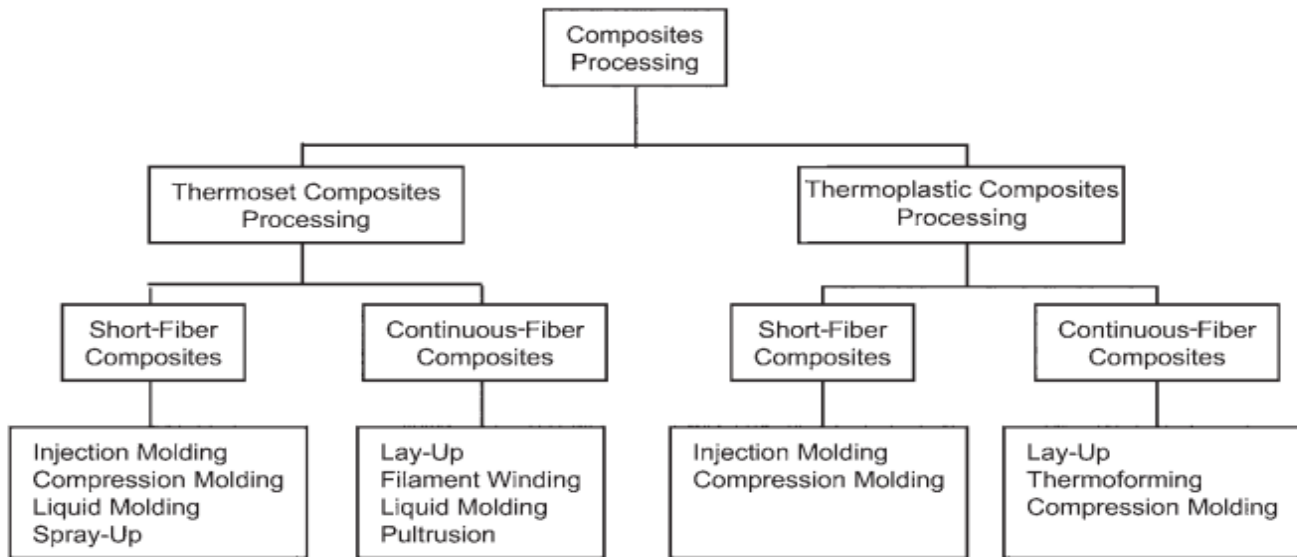


Fig. 1.3 Major polymer matrix composite fabrication processes

Advantages and Disadvantages of Composite Materials

The advantages of composites are many, including

- Lighter weight,
- The ability to tailor composites for optimum strength and stiffness,
- Improved fatigue life,
- Corrosion resistance, and,
- Good design practice,
- Reduced assembly costs due to fewer detail parts and fasteners.

Disadvantages of composites include

- High raw material costs
- Usually high fabrication costs
- Adverse effects of both temperature and moisture
- Poor strength in the out of plane direction where the matrix carries the primary load .
- Greater difficulty in repairing them compared to metallic structures