

Fig. 1.2 Formation of composites

### Types of Composite manufacturing techniques: -

- ✚ Lay-up
  - Hand lay-up
  - Spray lay-up
  - Prepreg Lay-Up
  - Automatic tape layup
- ✚ Prepregs
- ✚ Compression molding
  - Resin injection molding
  - Injection molding
- ✚ Bag molding
  - Pressure bag molding
  - Vacuum bag molding
- ✚ Resin transfer molding (RTM)
  - Flexible RTM (FRTM)



- Continuous RTM (CRTM)
- Vacuum assisted RTM (VARTM)
- High-speed RTM (HSRTM)

Moulding components

- SMC (sheet molding compound)
- BMC (bulk molding compound)

## (i) Prepregs:

Pre-impregnated fiber materials are called as prepregs. No thickening agent is used in making prepregs. Prepregs have a higher fiber content of 65%. They are available in both cloth or tape form. Usually, woven cloths are pre-impregnated, but woven rovings and chopped strand mats are also pre-impregnated.

### Characteristics of good prepreg

1. The prepreg should be flexible and tack free.
2. The fiber to resin ratio should be high and should not vary from place to place.
3. During moulding, the resin should be softening and flow filling the mold cavity should be without voids and defects.
4. Volatile contents and solvents should be minimum.

## (ii) Hand layup method:

It is the oldest molding method for making composite products. Manual lay-up involves cutting the reinforcement material to size using a variety of hand and power-operated devices.

These cut pieces are then impregnated with wet matrix material, and laid over a mold surface that has been coated with a release agent and then typically a resin gel-coat.



The major disadvantage is the lack of consistency;

1. Resins need to be low in viscosity to be workable by hand.
2. This generally compromises the mechanical and thermal properties of the composite and creates a health risk for the laminator.

The quality of the product is highly dependent on the skill of the laminator.

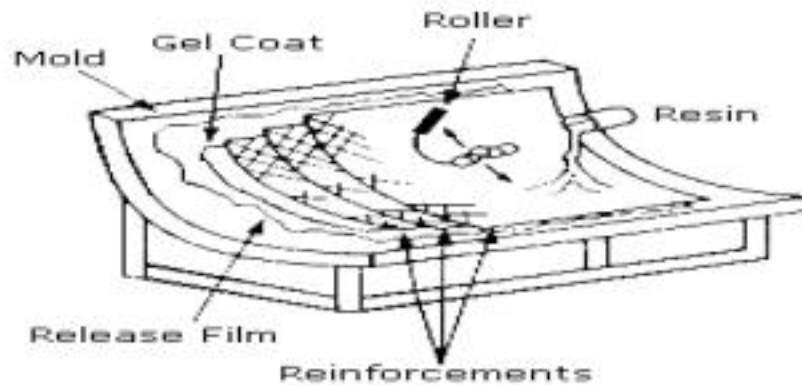


Figure 1.3 Hand layup method

### Process of pultrusion: -

1. Continuous roll of reinforced fibers/woven fiber mat
2. Tension roller
3. Resin Impregnator
4. Resin soaked fiber
5. Die and heat source
6. Pull mechanism
7. Finished hardened fiber reinforced polymer

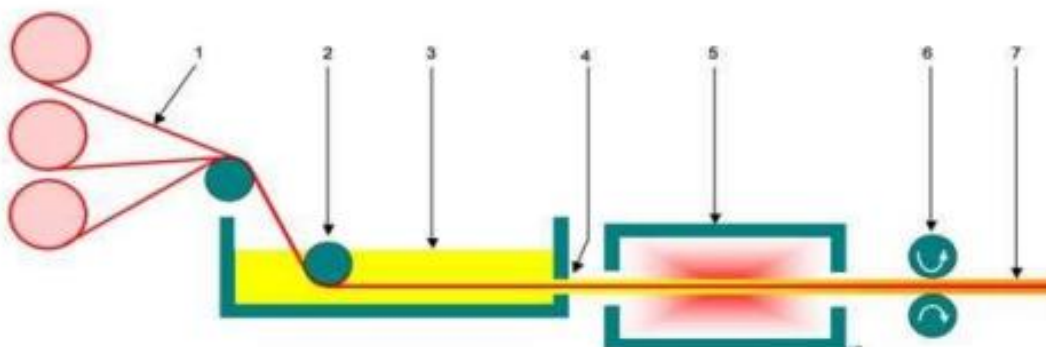


Fig. 1.7 Pultrusion process lay-out