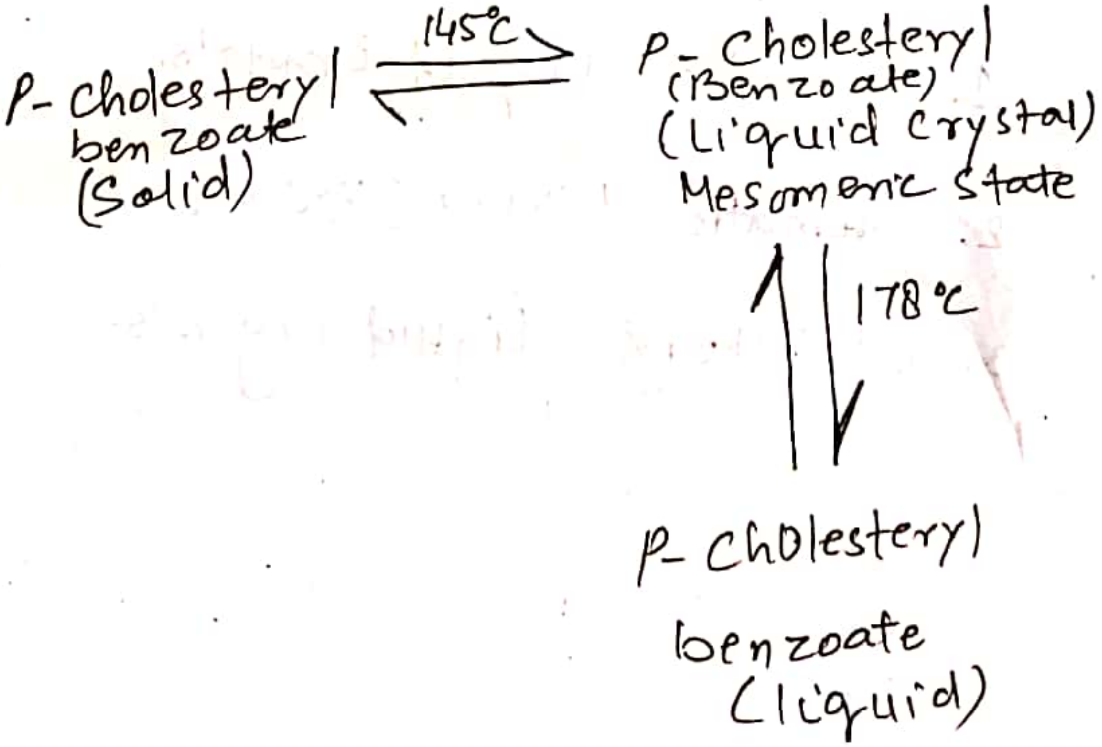
Liquid Crystals : The turbid liquids show anisotropy. They anisotropic properties are associated With crystalline state, thus the turbid Liquids are called liquid Crystals.

for examples, cholesteryl benzoate fuses sharply at 145°C giving a turbid liquid which on further heating changes sharply into a clear liquid at 178°C. The above changes get reversed on cooling. The changes are represented as.



Thus there are four state of matter viz. Solid, liquid and gaseous and mesomeric state or liquid crystal.

Classification of liquid crystals

Liquid crystals have been classified into the following three steps.

1. Smectic Liquid crystals.
2. Nematic liquid crystals.
3. Cholesteryl liquid crystals.

POLYMER COMPOSITES

Generally speaking, **a composite material is a combination of two or more materials that exhibit a significant proportion of the properties of all the constituent materials.** A combination of two or more distinct materials can provide better combination of properties such as strength, heat resistance or stiffness etc. Such composite material systems result in a performance which cannot be achieved by any of the individual constituents. Thus, the composite materials offer the great advantage of combining different materials to tailer make the desired properties as per the required specification.

11.12.1 Constituents of Composites

Composite materials generally comprise of just two phases

(i) The constituent forming the body of the composite, called the '**matrix**' and

(ii) The structural constituent called '**dispersed phase**' or the reinforcing material.

The properties of the composites are determined by the properties of the constituent phases, their relative amounts and their distribution and orientation.

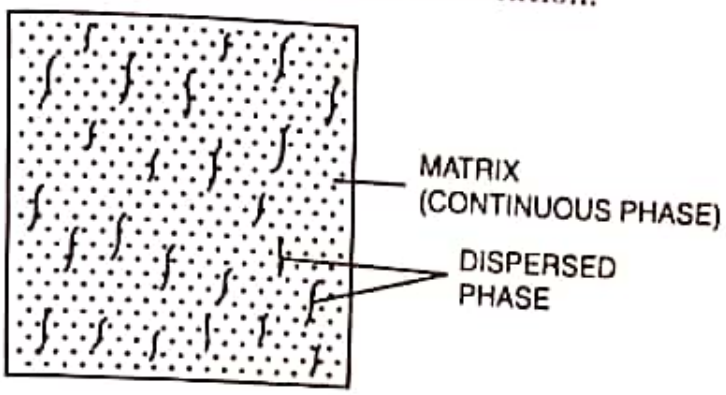


Fig. 11.5 Representation of a composite material

The most common example of a composite material is the **fiber glass reinforced plastic.** The plastic acts as the matrix and fibre glass is the dispersed phase. The plastic alone is relatively weak and has a low elastic modulus, bends and stretches easily. The glass fibers provide the strength and stiffness and their modulus of elasticity may be 50 times greater than that of plastic. Glass fibers take most of the load when the composite is stressed.

(i) **Matrix Phase**

The matrix phase of composites has several important functions like-

- It binds the reinforcing material (dispersed phase) together,
- protects the reinforcing material from surface damage due to mechanical abrasion or chemical reaction.
- It separates the individual particles of the reinforcing materials.
- It acts as a medium by which external load is transmitted and distributed to the dispersed phase.
- It prevents the propagation of brittle cracks because of its plasticity.

The matrix material should meet the following criteria.

- Its elastic modulus should be lower than that of the dispersed phase :
- It should be ductile.
- The adhesive bonding forces between the fiber and the matrix must be high. The ultimate strength of the composite depends on the magnitude of these forces.

Examples of some materials used as matrix include-polymers, metals and ceramics. Thus we have—

- Polymer matrix composites (PMC)
- Metal matrix composites (MMC)
- Ceramic matrix composites (CMC)

(ii) **The Dispersed Phase (reinforcement)**

To improve the strength of a matrix, the reinforcement must be stronger and stiffer than the matrix. These should possess high tensile strength.