5.2.1 Matrix Phase

It is the continuous body constituent (dispersion phase) which encloses the composite and gives its bulk form. It may be polymer, metal or ceramic material, and accordingly composites can be named either polymer matrix composites (PMC), metal matrix composites (MMC) or ceramic matrix composites (CMC).

Polyesters, vinyl esters, epoxies, phenolics and polyamides are the best examples of polymer matrix composites.

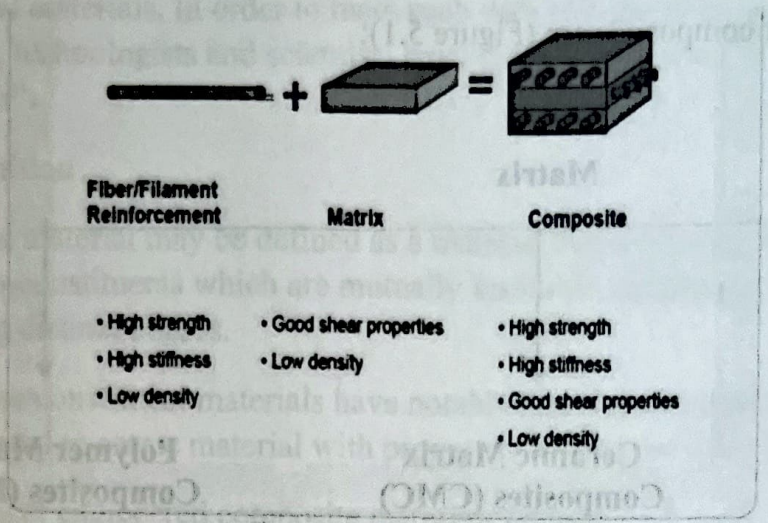
MMC is usually a low-density metal alloy, for example, Al, Mg, Ti. The metal alloys used in aircraft structures such as 2024 AI, 7075 AI and Ti-6AI-4V are popular matrix materials. Materials used in CMC include silicon carbide, silicon nitride, alumina, mullite, boron nitride and boron carbide.

5.2.2 Functions of Matrix Phase

- The role of matrix phase is to keep reinforcement particles in place and to support them. It **binds** the dispersed phase together.
- It acts as a **medium** to transmit and distribute externally applied loads to the dispersed phase and protect it from environment.
- It **protects** the dispersed phase from **surface damage** due to abrasion or chemical reaction and maintain **proper orientation** during application of loads.
- It **prevents** propagation of brittle cracks due to plasticity and softness.

A good matrix phase material should be ductile, corrosion-resistant and possessing low elastic modulus.

Figure 5.2 shows a composite made up of matrix phase and dispersed phase.



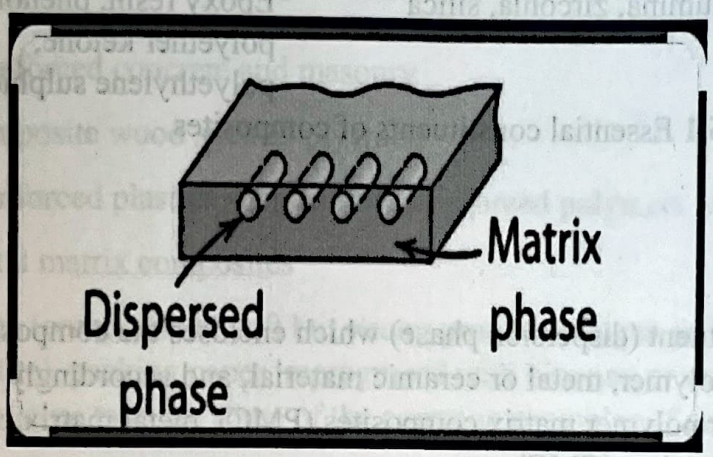


Figure 5.2 Composite made up of matrix phase and dispersed phase

5.2.3 Dispersed Phase

It is the structural constituent which determines the internal structure of a composite. The dispersed phase is sometimes called **reinforcement** if it is a phase added to increase strength. Alternatively, it is called a filler if it is added for other purposes, for example, to bulk up the matrix at low cost without affecting the properties of the composites.

The important dispersed phases of composites are:

1. Fibre: i) Glass fibre ii) Carbon fibre
2. Particulates: i) Large Particle ii) Dispersion Strengthening
3. Flakes
4. Whiskers.

Dispersed Phase/Reinforcement

The dispersed phases determine the internal structure of composite. It provides strength and stiffness to the composite. It is usually in the form of fibers, particles, or flakes embedded within the matrix. Common reinforcement materials include:

- **Fibers:** Such as glass fibers, carbon fibers, aramid fibers (e.g., Kevlar), and natural fibers e.g., bamboo, hemp.
- A special type of fibers widely known as whiskers
- Particulates, such as silica, alumina, or other ceramics
- Flakes, such as mica or graphite

Functions of Dispersed Phase

The dispersed phase, enhancing the overall properties of the composite dispersed phase:

- Increase Strength
- Enhance Stiffness
- Improve Toughness
- Control Thermal Properties
- Reduce Weight
- Enhance Wear Resistance
- Modify Electrical Properties
- Improve Corrosion Resistance

Overall, the dispersed phase significantly contributes to the improved mechanical, thermal, electrical, and chemical properties of composite materials, making them versatile and valuable for a wide range of applications.