1.1 WHAT ARE "COMPOSITES?

- Composite: Two or more chemically different constituents *combined macroscopically* to yield a useful material.

- Examples of naturally occurring composites permeated with holes filled with liquids
  - Wood: Cellulose fibers bound by lignin matrix
  - Bone: Stiff mineral "fibers" in a soft organic matrix permeated with holes filled with liquids
  - Granite: Granular composite of quartz, feldspar,and mica.
- A composite material is made by combining two or more materials– often ones that have very different properties.

- The two materials work together to give the composite unique properties.
- However, within the composite you can easily tell the different materials apart as they do not dissolve or blend into each other.

- Composite materials are materials made from two or more constituent materials with significantly different properties, that when combined, produce a material with characteristics different from the individual components.

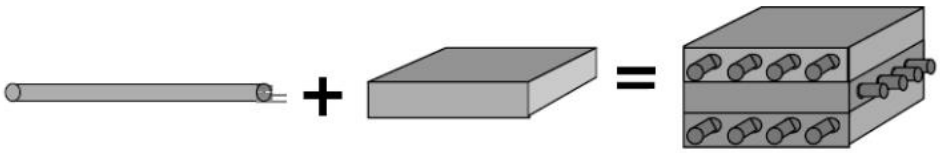
- Composite materials consist of two or more chemically distinct constituent on a macro scale having a dispersed interface separating them and having bulk performance which is considerably different from those of any of its individual constituents.

Examples:- Cement, Concrete, Fiber-reinforced polymer, etc.

Some examples of man-made composites

- Concrete: Particulate composite of aggregates (limestone or granite), sand, cement and water
- Plywood: Several layers of wood veneer glued together
- Fiberglass: Plastic matrix reinforced by glass fibers
- Cemets: Ceramic and metal composites
- Fibrous composites: Variety of fibers (glass, kevlar, graphite, nylon, etc.) bound together by a polymeric matrix

Composition of Composites



Fiber/Filament Reinforcement	Matrix	Composite
• High strength • High stiffness • Low density	• Good shear properties • Low density	• High strength • High stiffness • Good shear properties • Low density

1.2 THESE ARE NOT COMPOSITES :-

- Plastics: Even though they may have several "fillers", their presence does not alter the physical properties significantly.
- Alloys: Here the alloy is *not macroscopically heterogeneous*, especially in terms of physical properties.
- Metals with impurities: The presence of impurities does not significantly alter physical properties of the metal.

1.3 APPLICATION OF COMPOSITE MATERIALS :-

Automotive industry: Lighter, stronger, wear resistance, rust-free, aesthetics

- Car body Brake pads
- Drive shafts
- Fuel tanks
- Hoods
- Spoilers

Aerospace: Lighter, stronger, temperature resistance, smart structures, wear resistance

- Aircraft: Nose, doors, struts, trunnion, fairings, cowlings, ailerons, outboard and inboard flaps, stabilizers, elevators, rudders, fin tips, spoilers, edges
- Rockets & missiles: Nose, body, pressure tanks, frame, fuel tanks, turbo-motor stators, etc.

Sports: Lighter, stronger, toughness, better aesthetics, higher damping properties

- Tennis Bicycles
- Badminton
- Boats
- Hockey
- Golfing Motorcycles

Transportation & Infrastructure: Lighter, stronger, toughness, damping

- Railway coaches Bridges
- Ships and boats
- Dams
- Truck bodies and floors
- RV bodies
- Biomedical industry