RAMAIAH
Institute of Technology

BASICIS OF CIVIL ENGINEERING & MECHANICS

Course code:CV14/CV24

Credits:3:0:0

Basic Materials of Construction

Basic Materials of Construction

- Construction materials or Building materials is a material used for construction. Many naturally occurring substances, such as clay, rocks, sand and wood, have been used to construct buildings.

- Apart from naturally available materials, many man-made products are in use, some more and some less synthetic.

Basic Materials of Construction

- Materials used in building construction have to be selected carefully to ensure the safety and long-lasting life of the building

- There are many types of building materials used in construction such as Cement, Bricks, sand, Stones, Concrete, Steel, Wood and Masonry.

Bricks

- Bricks are one of the oldest and first building material (except wood) were made of mud molded by hand and dried in sun for a days until they were strong enough for use dating back to 7000BC

- The transition from the traditional method of production known as hand molding to a mechanized form of mass production slowly took place during the first half of nineteenth century.

Classification of Bricks

Based on the manufacturing process, bricks are broadly classified into two types,

1. Sun-Dried or unburnt bricks
2. Burnt bricks

Burnt bricks are classified into four types and they are

a) First class bricks
b) Second class bricks
c) Third class bricks
d) Fourth class bricks

Classification of Bricks

a) First class bricks

b) Second class bricks

c) Third class bricks

d) Fourth class bricks

Properties of Bricks

The following are the required properties of good bricks:

1. Colour
2. Shape
3. Size
4. Texture
5. Soundness
6. Hardness
7. Strength
8. strength
9. Water Absorption
10. Efflorescence
11. Thermal Conductivity
12. Sound insulation
13. Fire Resistance

Field and Laboratory tests on Bricks

- Absorption
- Crushing strength or compression strength
- Hardness
- Presence soluble salts
- Shape and size
- Soundness
- Structure
- Colour and Appearance
- Impact test

Advantages of Bricks

- Economical (Raw material is easily available)
- Hard and durable
- Compressive strength is good enough for ordinary construction
- Different orientations and sizes give different surface textures
- Very low maintenance cost is required

- Demolishing of brick structures is very easy, less time consuming and hence economic
- Reusable and Recyclable
- Highly fire resistant
- Produces less environmental pollution during manufacturing process

Disadvantages of Bricks

- Time consuming construction
- Cannot be used in high seismic zones
- Since bricks absorb water easily, therefore, it causes fluorescence when not exposed to air
- Very Less tensile strength
- Rough surfaces of bricks may cause mold growth if not properly cleaned
- Cleaning brick surfaces is a hard job
- Colour of low quality brick changes when exposed to sun for a long period of time

Cement

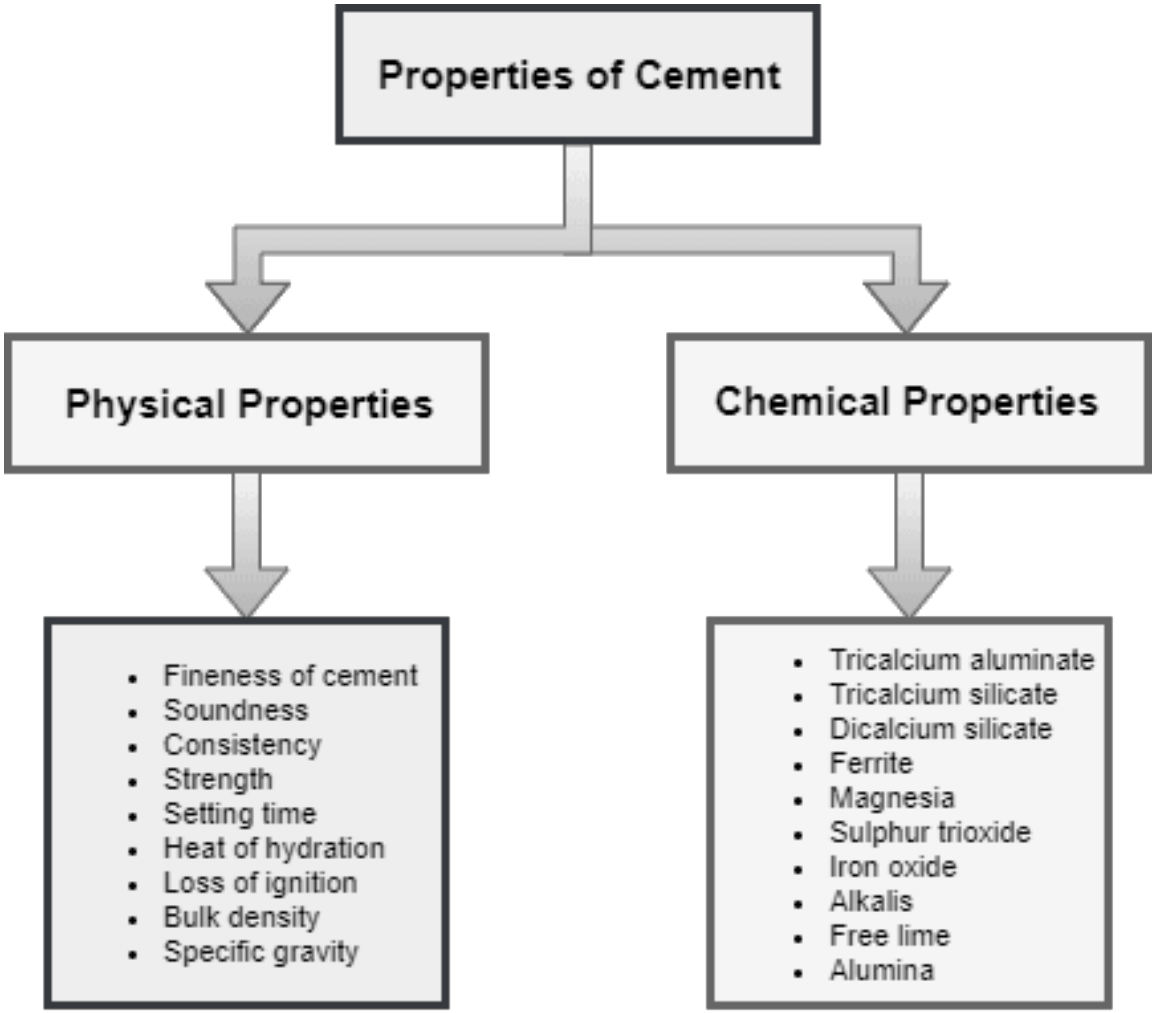
- A cement is a binder substance used for construction that sets, hardens, and adheres to other materials to bind them together.

- Cement mixed with fine aggregate produces mortar for masonry, or with sand and gravel, produces concrete.

- Cement can be classified into two distinct categories according to their respective setting and hardening mechanisms:

1. Non-hydraulic cement
2. Hydraulic cement

Cement


Properties of Cement
Physical Properties
Chemical Properties
Fineness of cement
Soundness
Consistency
Strength
Setting time
Heat of hydration
Loss of ignition
Bulk density
Specific gravity
Tricalcium aluminate
Tricalcium silicate
Dicalcium silicate
Ferrite
Magnesia
Sulphur trioxide
Iron oxide
Alkalis
Free lime
Alumina

Cement

Field tests conduct to check the quality of cement

1. Manufacturing date of cement.
2. Colour of cement.
3. Presence of lumps.
4. Adulteration test.

Cement

5. Temperature test.

6. Float test.

7. Strength test.

8. Set test.

Cement

Laboratory tests conduct to check the quality of cement

1. Fineness Test.
2. Consistency Test.
3. Setting Time Test.
4. Strength Test.

Cement

5. Soundness Test.
6. Heat of Hydration Test.
7. Tensile Strength Test.
8. Chemical Composition Test.

Types of Cement

1. Ordinary Portland Cement (OPC)
2. Portland Pozzolana Cement (PPC)
3. Rapid Hardening Cement
4. Quick setting cement
5. Low Heat Cement
6. Sulphate resisting cement

Types of Cement

7. Blast Furnace Slag Cement
8. High Alumina Cement
9. White Cement
10. Colored cement
11. Air Entraining Cement
12. Expansive cement
13. Hydrographic cement

Uses of Cement

- It is used in mortar for plastering, masonry work, pointing, etc.
- It is used for making joints for drains and pipes.
- It is used for water tightness of structure.
- It is used in concrete for laying floors, roofs and constructing lintels, beams, stairs, pillars etc.
- It is used where a hard surface is required for the protection of exposed surfaces of structures against the destructive agents of the weather and certain organic or inorganic chemicals.

Uses of Cement

- It is used for precast pipes manufacturing, piles, fencing posts etc.
- It is used in the construction of important engineering structures such as bridges, culverts, dams, tunnels, lighthouses etc.
- It is used in the preparation of foundations, watertight floors, footpaths etc.
- It is employed for the construction of wells, water tanks, tennis courts, lamp posts, telephone cabins, roads etc.

Mortar

Mortar is a workable paste which hardens to bind building units such as stones, bricks, and concrete masonry units, and also to fill and seal the Irregular gaps between them.

Functions of Mortar

- Binds together bricks or stones.
- Provides strength to the structure.
- It offers cohesion or force between the structural unit.

Mortar

- It serves as an important medium for uniformly distributing the forces through the structure.
- Imparts additional resistance and power against the rain dispersion and other such weathering agencies.
- It fills up empty joints in brick or stone masonry. Typically, a thin liquid mortar known as Grout is used for such purposes.

Properties of Mortar

- Workability
- Strength
- Water retention
- Adhesive properties
- Durability
- Crack resistance

Types of Mortar

Based on the binding material used

- Cement Mortar
- Lime Mortar
- Gypsum Mortar
- Gauged Mortar
- Surkhi Mortar
- Aerated Cement Mortar
- Mud Mortar

Types of Mortar

Based on it's application

- Bricklaying Or Stone-Laying Mortar
- Finishing Mortar
- Thin set

Based on the Bulk Density

- Heavy Mortar
- Light Weight Mortar

Special Purpose Mortar

- Fire Resistant Mortar
- Packing Mortar
- Sound Absorbing Mortar
- Chemical resistant Mortar
- X-ray shielding Mortar

Plain Cement Concrete:

Plain cement concrete is the mixture of cement, fine aggregate (sand) and coarse aggregate without steel.

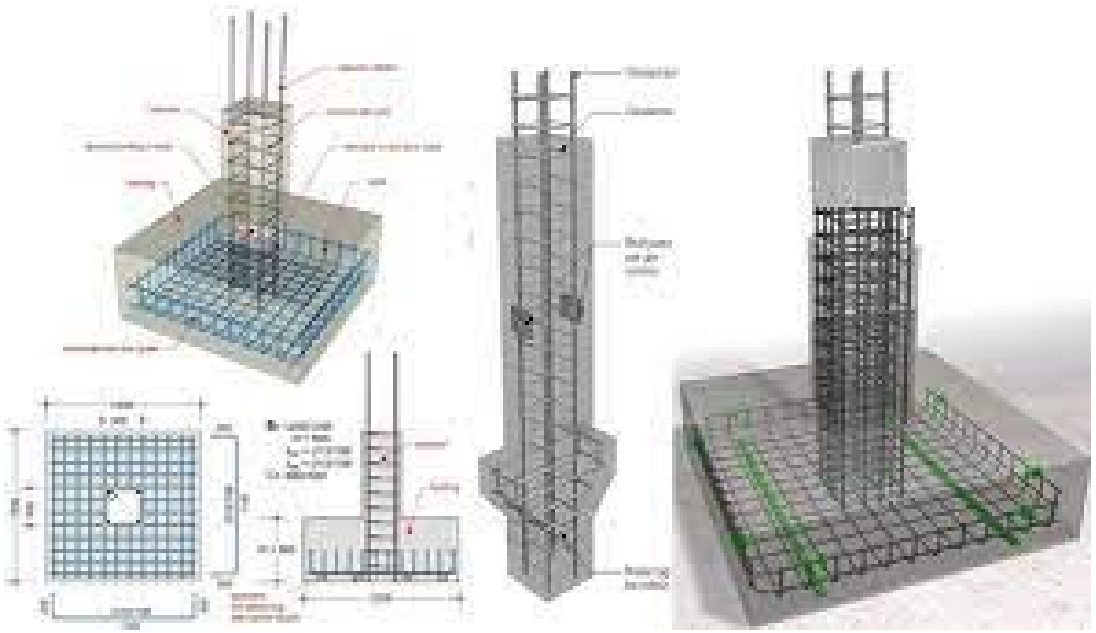
Uses: For foundation work and Building Flooring.

Reinforced Cement Concrete:

1. Reinforced cement concrete (RCC) is PCC + reinforcement.

2.The reinforcement can be both tensile or compressive reinforcement depending upon the situation.

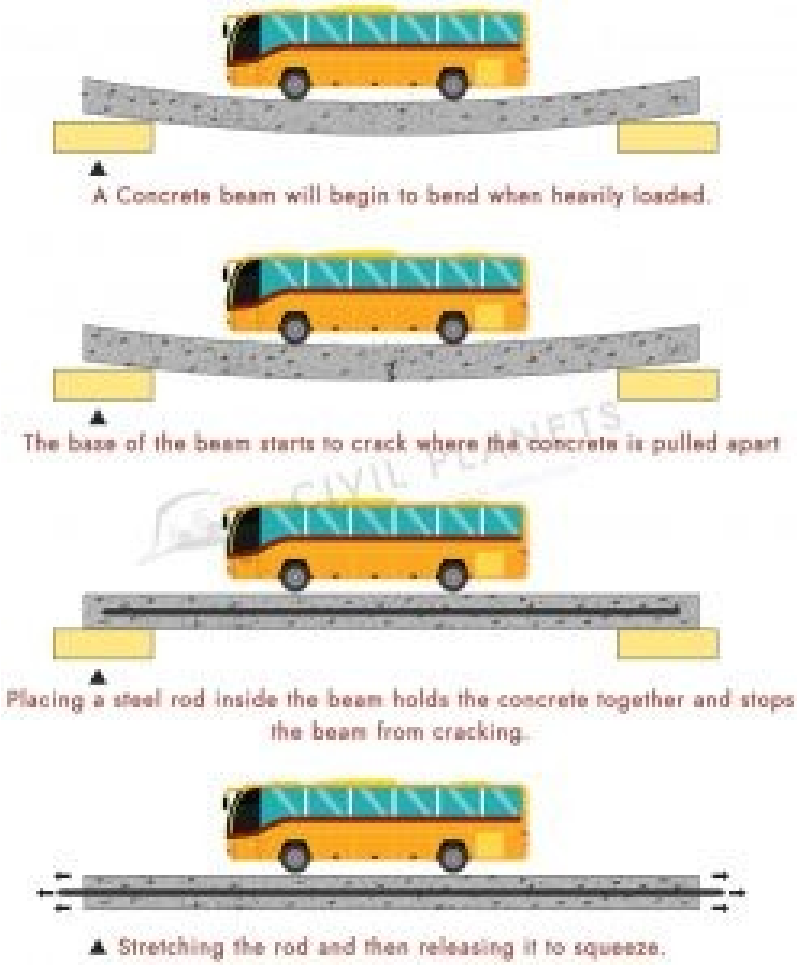
Uses: Construction of bridges, dams, piers, tall buildings.



Prestressed Concrete:

"Pre-stressed concrete is a form of reinforced concrete that builds In compressive stresses during Construction to oppose those found when in use."

In other words it is a combination Of steel and concrete that takes advantages of the strengths of each Material.



Applications of Prestressed Concrete

1. Bridges
2. Slabs in buildings
3. Water tanks
4. Concrete Pile
5. Thin shell structures
6. Offshore platform
7. Nuclear Power Plant
8. Repair and Rehabilitations

RAMAIAH Institute of Technology

DEPARTMENT OF CIVIL ENGINEERING

Course: Basics of Civil Engineering & Mechanics
Credits: 3:0:0

RAMAIAH
Institute of Technology

BASICIS OF CIVIL ENGINEERING & MECHANICS

Course code:CV14/CV24

Credits:3:0:0

Structural steel

Structural steel is a carbon steel, meaning it has a carbon content of up to 2.1 percent by weight. After iron, carbon is the most important element in carbon steel

Properties of Structural steel

1. Density
2. Elastic Modulus
3. Poisson's Ratio
4. Tensile Strength
5. Yield Strength
6. Melting Point
7. Specific Heat
8. Hardness

Applications of Structural Steel

Role of Water in Construction

Water is the most important & least expensive ingredient of concrete. It plays an important role in mixing, laying, compaction, setting & hardening of concrete.

The functions of water in the concrete mix are given below:

1. It acts as a lubricant for the fine and coarse aggregate & makes the mixture workable.
2. It acts chemically with cement to form the binding paste.

Role of Water in Construction

1. It is employed to damp the aggregate surface in order to prevent them from absorbing water vitally necessary for chemical action.
2. It facilitates the spreading of aggregate.
3. It helps to flux the cementing material over the surface of the aggregate.
4. It enables the concrete mix to flow into moulds.

Quality Of Mixing Water In Concrete

1. It should be fresh & clean.
2. It should be free from organic impurities injurious amounts of acids or alkalies, hygroscopic, greasy & oily substance.
3. It should be free from iron, vegetable matter, or any other substance which is likely to have an adverse effect on concrete or reinforcement.
4. It should be fit for drinking purpose.
5. The PH value shall generally be between 6 and 8.

Construction Chemicals

Construction chemicals have always been playing important roles in virtually all sorts of construction projects, be it industrial projects, residential building projects, commercial building projects and so on.

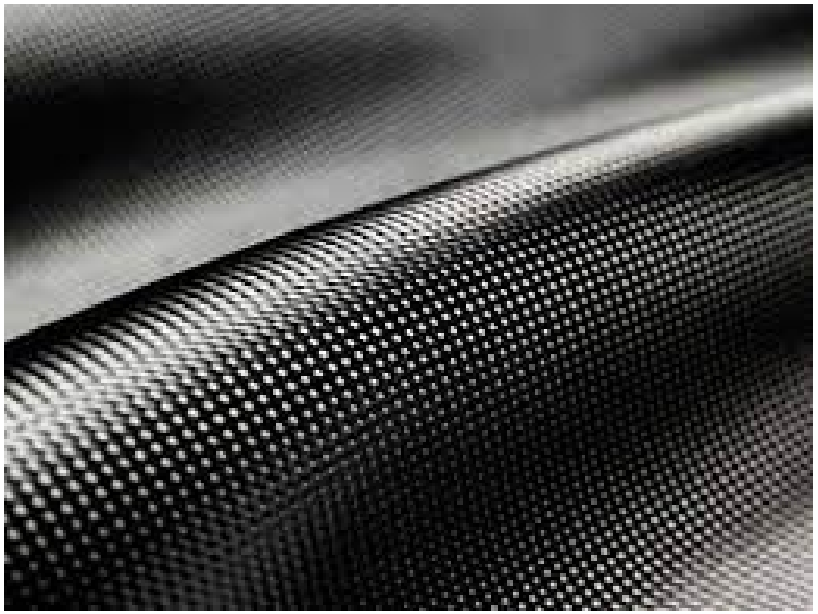
These chemicals are often used in various elements of projects in order to achieve various important qualities such as workability, durability etc. Construction chemicals exist in many varieties from a large number of manufacturers worldwide.

Types of Construction Chemicals

1. Concrete Hardeners
2. Protective and Decorative coating
3. Epoxy Coating
4. Mould Releasing Agents
5. Polymer Bonding Agent
6. Ready Mix Plaster
7. Waterproofing Chemicals

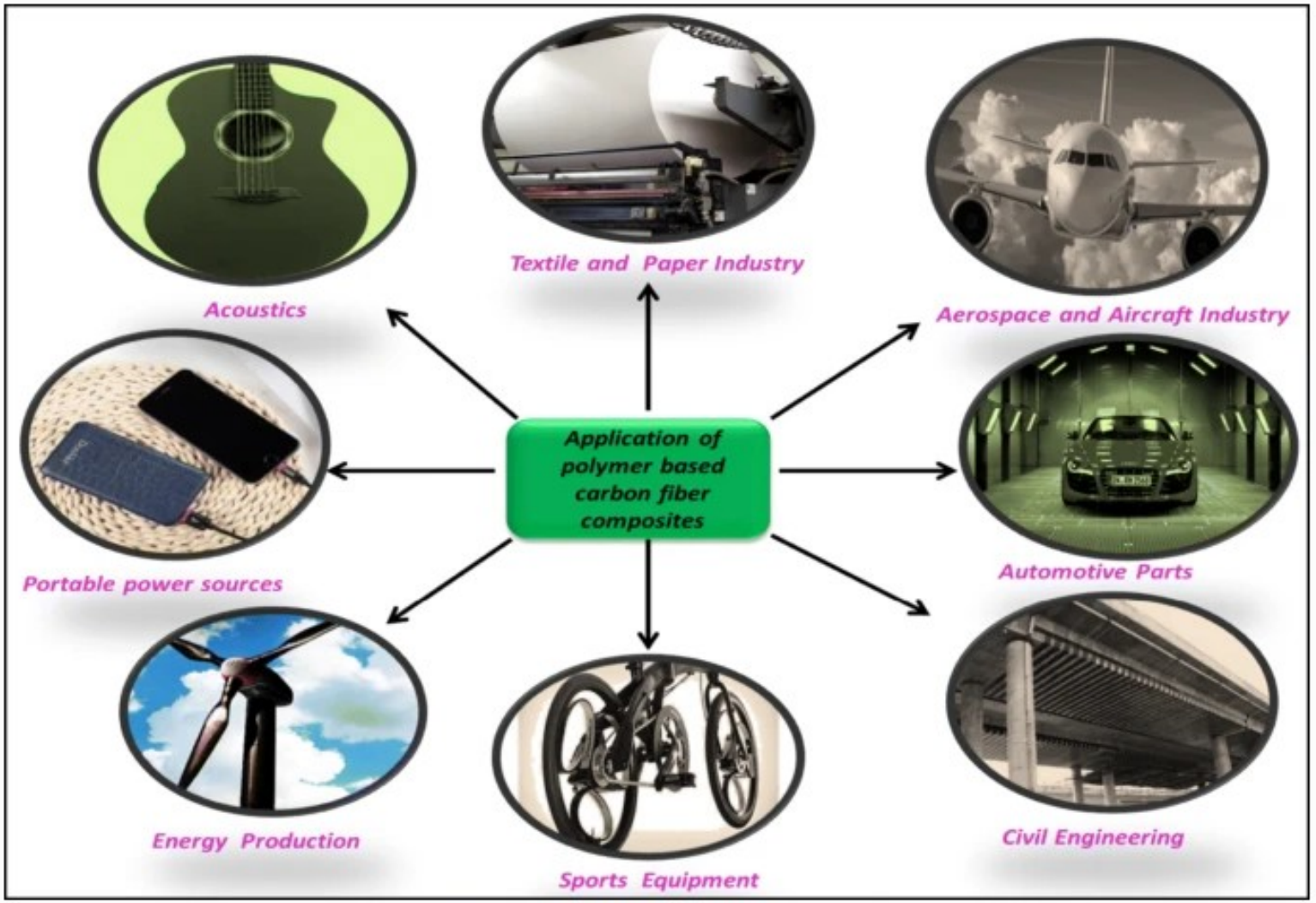
Carbon Composites

Carbon/carbon composites are special kind of composite that consists of carbon fibers embedded in a carbonaceous matrix.



Properties of carbon-carbon composites material

1. High temperature resistance
2. Thermal shock resistance
3. Low thermal expansion coefficient
4. Small heat capacity
5. Low density
6. Excellent corrosion resistance and radiation performance.


Application of polymer based carbon fiber composites
Acoustics
Textile and Paper Industry
Aerospace and Aircraft Industry
Portable power sources
Automotive Parts
Energy Production
Sports Equipment
Civil Engineering

Plastic in Construction

Properties

- Appearance
- Chemical resistance
- Dimensional stability
- Ductility
- Durability
- Electric insulation
- Finishing
- Fire resistance
- Fixing
- Humidity

Applications of Plastic in Construction Industry

- Facade panels, exterior covering, carpentry
- Interior Covering, Floors, Walls, Ceilings, Doors, Partitions
- Sanitary Equipment and Piping