

Materials and engineering:

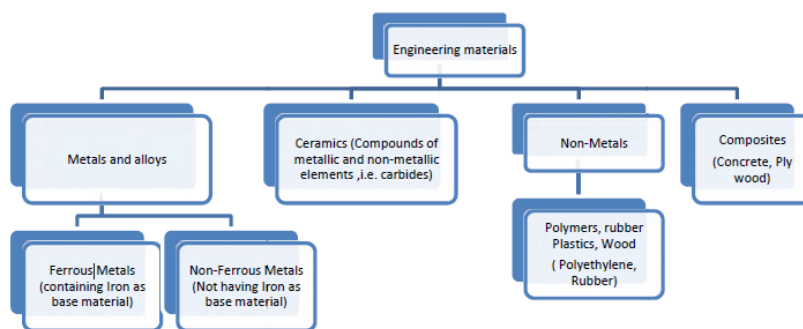
The creative application of scientific principles to design or develop structures, machines, apparatus, or manufacturing processes, or works utilizing them singly or in combination; or to Construct or operate the same with full cognizance (awareness) of their design; or to forecast their behaviour under specific operating conditions; in all respects of an intended function, economics of operation or safety to life and property.

Now relating the materials with the engineering we can say that materials engineering is the designing or engineering the structure of a material to produce the predetermined set of properties in the material.

Classification of engineering materials:

1. Classify the engineering materials.

The engineering materials are those materials which are used for engineering and structural Purpose, such as to make bridge, road, machine, building, etc. these can be classified as:



Industrial application of engineering materials:

Sl. No.	Classification	Engineering Material	Application
1	Metals	Steel	Used for making of buildings, automobiles, trains, machine and their components.
2	Non-metals	Gold	Used for making of ornaments, computers, coins.
		Plastics	Used for making of pipelines, cable insulations, chairs.
		Wood	Doors, windows, bridges, furniture.
3	Ceramic	Aluminum oxide	Used in the grinding wheels, abrasives
		Silicon carbide	Used in the cutting tools.
4	Composites	Fiberglass	Used in the making of bulletproof jackets.
		CFRP	Used for aerospace and sports applications.
5	Advanced Materials	Semiconductors, Bio-Materials, Smart Materials, Shape memory alloy	Used in the making of electronic equipments, Used in the replacement of damaged body parts, Used in the sensors and actuators.

Importance of Materials and Manufacturing

One can easily understand the significance of Materials and Manufacturing if he carefully observes the different types of products around him, and used in daily life, viz., a Pen, a Steel rule, a Stapler, a Paper Punch, a Telephone, an Auto Vehicle, an Aircraft, various types of Electronic Gadgets, Medical Equipment and Surgical Instruments, House hold goods, etc. to cite a few examples. All such articles are not directly obtained from nature. They are converted from Raw Materials, obtained from nature in various forms, through a number of operations to bring them to the forms in which they are used. These usable forms are actually the net results of different Manufacturing Processes.

In essence the importance of materials and manufacturing can be realised from the fact that "In absence of the materials and manufacturing processes, our civilisation would

Classification of Plain carbon steels

Type	% of Carbon	Property	Uses/ Application
Dead mild steel (DMS)	Below -0.15	Good ductility and formability	Rods and sheets
Mild steel (MS)	0.15-0.3	Good weld ability	Structural sections, making of doors and angles
Medium carbon steel (MCS)	0.3-0.6/0.8	Good strength and toughness	Axles, springs and gears, Hand tools
High carbon steel (HCS)	0.8 and above upto 2.0%	High wear resistance & hardness	Dies, drills and cutting tools

Wrought Iron: It is the purest form of iron 99.9 % pure. It is corrosion resistant, malleable and soft. It was used for agricultural implements, ship anchors and railway couplings. Its use has been replaced by steels.

Cast iron:

Cast Iron: It is primarily an alloy of iron and carbon. The carbon percentage varies from 2 to 4.5 per cent. It also contains small amount of silicon, manganese, phosphorus and sulphur. The cast iron is obtained by re-melting pig iron with coke, limestone and steel scrap in a furnace known as cupola.

Properties of cast iron:

- a) Cast iron is brittle.
- b) Cast iron is weak in tension so it cannot be used for making bolts and machine parts which are liable to tension.
- c) It is having low cost.
- d) It is having good casting characteristics.
- e) High compressive strength.
- f) High wear resistance.
- g) Good corrosion resistance

Uses of Cast Iron:

- a) In the making of castings, hand pump.
- b) Water pipes
- c) Sewerage pipelines
- d) Beds of machines such as lathe machine, drill machine, etc.
- e) Bodies of motors and engines

Classification: Cast Iron may be classified as grey cast iron, white cast iron, mottled cast iron, nodular cast iron, and malleable cast iron.

