

Classification of steel

STEEL is an alloy of iron with other elements.

- I. **Plain carbon (or) non alloy steels**
 - a) Low carbon steels
 - b) Medium carbon steels
 - c) High carbon steels
- II. **Alloy steels**
 - a) Low alloy steels
 - b) High alloy steels

(Explain the classification of plain carbon steel with its properties and application.)

I. **Plain Carbon steel**

Carbon is the alloying element that defines the properties of the alloy.

Composition of plain carbon steels:

- up to 1.5% Carbon
- up to 1.65% Manganese
- up to 0.6% Copper
- up to 0.6% Silicon

Characteristics of plain carbon steels:

- moderately priced steels due to the absence of large amount of alloying elements.
- sufficiently ductile

Applications of plain carbon steels:

- mass production products such as automobiles and appliances.
- production of ball bearings base plates housing, chutes, structural member etc.

a) **Low carbon steels:**

- They are known as mild steels.
- contain less than about 0.25% carbon.

Characteristics of low carbon steels:

- relatively soft and weak.
- cannot be hardened by heat treatment.
- Strengthened by cold working.
- have outstanding ductility and toughness.
- micro structure of low carbon steels consists of ferrite and pearlite constituents.
- least expensive to produce.

Applications of Low carbon steel

- Building frames in construction projects
- Machinery parts
- Cookware
- Pipelines

- Metal gates and fencing

b) Medium carbon steels

- Contains between 0.25 and 0.60% of carbon.
- may be heat treated, quenched and then tempered to improve their mechanical properties.

Characteristics of medium carbon steels:

- low hardenabilities.
- good formability and weldability
- Application of medium carbon steels:
- railway wheels, railway tracks, gears, crank shafts, and other machine parts.

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c) High-Carbon Steels:

- have more than 0.6% carbon

Characteristics of high carbon steels:

- hardest, and strongest of the carbon steels.
- least ductile of the carbon steel
- more wear resistant.
- They are capable of holding a sharp cutting

Application of high carbon steels:

- cutting tools and dies
- knives, razors,
- hack saw blades,
- springs and high strength wire.

II. Alloy steels:

Alloy steels are any steels other than carbon steels.

Composition:

Manganese -1.65, silicon – 0.6%, copper – 0.6%

Alloying elements:

chromium, nickel, molybdenum, vanadium, tungsten, cobalt, boron, copper etc.,

Purpose of Alloying:

- To increase its strength
- To improve hardness
- To improve toughness
- To improve resistance to abrasion and wear
- To improve machinability
- To improve ductility
- To achieve better electrical and magnetic properties

Classification of Alloy steels:

Alloy steels can be divided into two main groups: Low alloy steels and high alloy steels

a) Low alloy steels:

- contain up to 3 to 4% of alloying elements.
- Have better mechanical properties that prevent corrosion,
- Have high temperature performance.

Applications:

- Pipes
- Automotive & aerospace bodies
- Railway lines, off shore & onshore structured engineering plates.

b) High Alloy steels:

- more than 5% of one or more alloying elements.
- The room temperature structures after normalizing may be austenitic, martensitic or contain precipitated carbides.

Applications

- Automobiles
- Ship building
- Railways, aircrafts
- Finds use in low temperature applications due to its high toughness.

(Explain the cast iron micro structure, properties and application in detail.)

Micro structure of cast iron

Cast iron, an alloy of iron that contains 2 to 4 percent carbon, along with varying amounts of silicon and manganese and traces of impurities such as sulfur and phosphorus.

Types of cast iron

- 1. Grey cast iron**
- 2. White cast iron**
- 3. Malleable cast iron**
- 4. Spheroidal graphite cast iron or nodular cast iron**
- 5. Alloy cast iron**

1. Gray cast iron

- It is the most common type of cast iron.
- It has graphite microstructure consisting of many small fractures giving gray colour.
- When gray cast iron is produced, the fractures open up to reveal the gray-colored graphite underneath the surface.
- Gray cast iron is not as strong as steel, nor is it able to absorb the same shock as steel.
- gray cast iron offers similar compressive strength as steel.