

UNIT – III

FERROUS AND NON- FERROUS METALS.

3.3 CAST IRON :

The material which contain 2 to 6.67% carbon is called as cast iron. It is obtained by re-melting pig iron with coke and lime stone in a cupola furnace .It is a brittle material.

Properties :

High compressive strength.

High wear resistance.

Good machinability.

Low melting temperature (1250^oc).

Good castability.

Low cost.

Ability to make good casting.

Good corrosion resistance.

Composition of Cast iron:

C → 3-4%, Si → 1-3%, S → upto 0.1%, P → upto 0.1%, Mn → 0.5 -1%, Remaining iron.

Applications :

Pipe Fittings.

Farm equipments.

Gears.

Machine tool.

Automobile components.

Dies.

Electrical motors.

3.4 TYPES OF CAST IRON:

Grey cast iron.

white cast iron.

Malleable cast iron.

Nodular cast iron (or) spheroidal (or) Ductile.

Alloy cast iron.

1. Grey Cast iron:

Grey cast iron, is a type of cast iron that has a graphitic microstructure. It is named after the gray color of the fracture it forms, which is due to the presence of graphite. It is the most common cast iron and the most widely used cast material based on weight. The carbon is in the free form as “Flakes” of graphite. Ferrite Micro-structure.

Composition:

C → 2.5 – 4%, Si → 1 – 3%, Mn → 0.4 – 1%, P → 0.15 – 1%, S → 0.02 – 0.15%, Remaining – iron

Properties:

- Good wear resistance.
- Good corrosion resistance.
- Good Mach inability.
- High tensional, shear strength.
- High hardness.

Application:

Machine tool bodies, engine cylinders, brake drums, camshaft, pipe Fitting, rolling mills, agriculture equipment.

White cast iron:

White cast iron is a cast iron without any alloy addition and with low C and Si content such that the structure is hard brittle iron carbide with no free graphite. A fast cooling rate prevents the precipitation of C as graphite. All the carbon is in the combined form as iron carbide. Cementite micro structure.

Composition:

C→ 1.8 to 3%, Si→ 0.5 to 1.9%, Mn→ 0.25 to 0.8%, P→ 0.05 to 0.2%, S→ 0.1 to 0.3%, remaining – iron.

Properties:

- Very hard and brittle.
- High wear resistance.
- High tensile strength.
- Low compressive strength.
- High hardness.
- Difficult to Machine.

Applications:

- Wearing plates.
- Road roller surface.
- Pump liners.

Grinding balls.

Dies.

Nozzles.

For production of Malleable castings.

3.11 MALLEABLE CAST IRON:

The carbon is in the free forms irregular round particles of graphite known as temper carbon. This is obtained by heat treatment of white cast iron. Cementite in white cast iron Micro structure breaks down into ferrite and graphite.

Composition:

C → 2 to 3%, Si → 0.6 to 1.3%, Mn → 0.2 to 0.6%, P → 0.15%, S → 0.1%, Remaining – iron.

Properties:

Good ductility and Machine ability.

High yield strength.

High young's Modulus and low – coefficient of thermal expansion.

Good wear resistance.

High tensile strength.

High hardness.

High toughness.

Applications:

Automobile industries.

Farm equipments.

Pipe Fittings.

Chains.

Bearing blocks.

Agricultural machines.

3.12 NODULAR CAST IRONS , DUCTILE CAST IRON (OR)

SPHEROIDAL GRAPHITE CAST IRONS:

Nodular Cast Iron, also referred to as ductile iron or spheroidal graphite iron, is a group of irons in which the graphite forms as nodules (spherical) instead of flakes as in normal cast iron. Nodulizing elements, typically magnesium, are used to allow the solidification of the graphite into nodules. The carbon is in free form as nodules of graphite formed directly during the process of solidification.

Composition:

C → 3.2 to 4%, Si → 1.8 to 3%, Mn → 0.2 to 0.5%, P → 0.08% Max, S → 0.1% Max, Remaining – iron.

Properties:

Good ductility.

Good tensile and yield strength.

Good toughness.

Good fatigue.

Good impact strength.

Good hardness.

High modulus of elasticity.

Good Mach inability.

High Hardness.

Application:

Crank shafts.

Gears.

Sheet metal dies.

Furnace doors.

Cylinder blocks.

Bearing blocks.

Pipes.

3.13 ALLOY CAST IRONS:

Alloy cast irons may be of any of the general types and are modified by the addition of alloying elements to obtain specific properties. Alloying element like Ni, Cr, Mo, Si, Mn.

Composition:

Ni → 14 – 36 %, Cr → 1.5 %, Cu → 5 – 8 %, C → 2 to 2.3 %, Si → 5 to 6.

Two types of Alloy cast iron:

Ni – resist cast iron.

Ni – hard cast iron.

Properties:

High tensile strength.

More brittle.

Good corrosion resistance.

High wear resistance.

Applications:

Generator, Motor covers, gas turbine, furnace, impellers, cylinder Liners.

Effect of chemical composition in cast irons:-cast irons contain upto 10% of alloying elements like carbon, silicon, Manganese, sulphur and Phosphorus.

Factors affecting structure of cast irons:

Rate of cooling.

chemical composition.