

UNIT – III

FERROUS AND NON- FERROUS METALS.

3.4 NON – FERROUS METALS AND ALLOYS:

Non ferrous metals and alloys are those Which do not contain iron, these metals are not iron based metals.

Lighter in weight.

Good resistance to corrosion.

It is having good electrical and thermal conductivity.

Non – Ferrous materials and their alloying elements.

Copper.

Aluminium.

Magnesium.

Lead.

Nickel.

Tin.

Zinc.

Cobalt.

(i) Copper :

It is one of the most widely used non – ferrous metals in industries. Copper alloys cannot be hardened by heat treatment procedures. It may be cast, forged, rolled and drawn into wires.

Properties:

High electrical conductivity.

High thermal conductivity.

Good corrosion resistance.

It is very soft, ductile and malleable.

It can be worked both in hot and cold conditions.

It is light in weight.
Very good machinability.
Non – magnetic properties.

Applications:

It is used to make electrical parts like wire, switches etc.
Heat Exchanger tubes.
It is used to make various copper alloys like brass and bronze.
It is used to make screw machine products.

New grades of copper:-

Arsenial copper
Free cutting copper
Silver bearing copper
Tough pitch copper
Oxygen free copper
De oxidized copper.

3.15 COPPER ALLOYS:

They are classified as:

Brasses (Copper – Zinc alloy)
Bronzes (Copper – tin alloy)
Copper – nickel Alloys (Cupronickel)
Gun metal (Copper – tin – Zinc alloy)

3.15.1 BRASSES (COPPER – ZINC ALLOY) :

Brass is an alloy of copper and zinc sometimes small amount of other metals such as tin, pb, Al and nig are added. upto 36% zn brass is a single phase solid solution called as α brass. Brass having more than 30% zn have a twp phases α and β .

Properties:

It is stronger than copper.
Low thermal conductivity.
High tensile strength.
Good surface finish.

Non – magnetic.

Poor conductor of electricity.

Soft and ductile.

Application:

Decorative work, making coins, medals, screws, Bullets, plumbing fittings.

Brasses are classified based on the structure as

α - Brasses.

$\alpha - \beta$ Brasses.

3.15.2 BRONZES (COPPER – TIN ALLOY) :

Bronze is an alloy of copper and Tin. Bronze contains silicon, aluminum and nickel.

composition:

Copper \rightarrow 90%, Tin \rightarrow 9 to 10%, Phosphorus \rightarrow 0.1 to 0.3%.

Properties:

High strength alloy.

Good corrosion resistance.

High elasticity.

Hard and brittle.

Good cold working properties.

Low coefficient of friction.

High toughness.

Applications:

Making bells, Boiler parts, Marine components, Die cast parts, pump components, propeller, air pump, gears etc.

Types of Bronze :

Phosphor bronze.

Silicon bronze.

Beryllium bronze.

Manganese bronze.

Phosphor bronze :

Copper → 87% to 90% Tin → 9% to 10% Phosphorus → 0.1% to 0.3%.

Silicon bronze :

copper → 96%, silicon → 3%, Manganese (or) zinc → 1% .

Beryllium bronze:

copper → 97.75% , Beryllium → 2.25% Beryllium.

Manganese bronze :

Copper → 60% Zinc → 35% Manganese → 5%.

3.15.3 COPPER – NICKEL ALLOYS (OR) CUPRO NICKEL:

It is an alloy of copper and Nickel. They have better corrosion resistant than any other copper alloys. They can be hot or cold work.

Types of Cupro Nickel:

Cupro Nickel → 70Cu, 30% Ni.

Mono metal → 29 Cu, 68 Ni, 1.25 Fe, 1.25 Mn.

K – Metal → 29 Cu, 66Ni, 2.75 Al, 0.4Mn, 0.6 Ti.

Properties:

Good Mechanical properties.

High corrosion resistant.

Application:

Salt water pipe, condenser tubing, for making propeller, Motor boat propeller shaft, chemical and food handling parts.

3.15.4 GUN METAL :

Gunmetal is a grey corrosion-resistant form of bronze containing zinc. It is an alloy of copper, tin and Zinc.

Composition:

cu – 88%, Zn – 2%, Tin – 10%

Properties:

High corrosion resistant.

Good casting properties.

High strength.

Good machinability.

Application:

Bearing bushes, Boiler fitting, Steam pipe fitting, Marine castings, Hydraulic valves, gears
etc.