Compiled by
Dr. Arbind Prasad
Assistant Professor(Mech. Engg.)
Katihar Engineering College,Katihar
Bihar, India-854109

NON-FERROUS ALLOYS

(2 Marks)

Q.1.Write the composition of duralumin?

Ans: It consists of Al=95%, Cu=4%, Mn=0.5%. Mg=0.5%.

Q.2. Write the composition of Babbitt's metal?

Ans: Lead or tin based alloys are called Babbitt's metal.

Composition:

Lead base alloy=Pb=75%, sb=15%, sn=10%

Tin base alloy=Sn=88%, Sb=8%, Cu=4%

Q.3.What is the composition of brass?

Ans:- Cu=60-90%,

Zn=40-10%,

Q.4. Give the composition of Duralumin?

Ans.- Cu=3.5-4.5%
Mn=0.4-0.7%
Mg=0.4-0.7%
Fe or Si<0.7%
Al=rest.

Q.5. Name any fur metal used for nuclear energy?

Ans: Metal used for nuclear energy are

- Uranium
- Plutonium
- Thorium
- Zirconium
- Beryllium
- Niobium

5 MARKS

Q.1. Name the alloys used for high temperature service?

Ans: Duralumin: It contains

Cu 3.5-4.5%

Fe or Si <0.7%

Mn 0.4-0.7%

Compiled by
Dr. Arbind Prasad
Assistant Professor(Mech. Engg.)
Katihar Engineering College,Katihar
Bihar, India-854109

Al Balance

Mg 0.4-0.7

Q.2.Describe composition properties and application of Zn alloys?

Ans: Zinc and zinc based alloys

- Zinc is a blue to gray metallic element.
- Zinc has following characteristics.
- Relatively low melting point.419.5°c (die casting)
- Good resistance to atmospheric corrosion.
- Solubility in copper(brass)
- Inherent ductility and malleability.

7 MARKS

Q.1. Describe the composition, properties and use of aluminum alloys such as duralumin, y-alloy?

Ans:-

Types of aluminum alloys

- Aluminum alloys contain
  - Al-Mn
  - Al-Mg
  - Al-Mg-Mn
  - Al-Mg-Si
  - Al-Cu-Mg
  - Al-Cu-Si
  - Al-Cu-M-Pb
  - Al-Mg-Si-Pb
  - Al-Zn-Mg-Cu
- Aluminum alloys can be classified as follows.
  - Wrought alloys
  - Cast alloys
  - Heat treatment alloys
  - Non heat treatment alloys

For Duralumin: it contains

Compiled by
Dr. Arbind Prasad
Assistant Professor(Mech. Engg.)
Katihar Engineering College,Katihar
Bihar, India-854109

- Cu 3.5-4.5%
- Mn 0.4-0.7%
- Mg 0.4-0.7% Fe or Si <0.7%
- Al balance

Duralumin possesses:

*High machinability.

*High tensile strength after heat treatment

*Strength as high as steel but has only about 1/3 of its weight

*Excellent casting and forging properties

Duralumin finds the following uses:

*Aircraft and automobile part.

*As bars, sheets, tubes, and rivets

*As light structures and extruded sections

For Y-alloy:

Copper=3.5-4.5%

Manganese=1.2-1.7%

Nickel=1.8-2.3%

Silicon, magnesium iron =0.6% each the remaining is aluminum.

Q.2.Describe composition properties, and application of zinc alloys?

Ans: Composition: -

Rolled zinc:

Pb=0.05 to 0.12 Fe=0.012 to max

Cd=0.005 to max Cu=0.65 to 1.25

Zn=remainder

High grade slab zinc:

Pb=0.07, Fe=0.02, Cd=0.07(Pb+ Cd+ Fe)=>Zn=Remainder

Selected grade slab zinc:

Pb=0.08,Fe=0.04,Cd=0.75(Pb+ Cd=Fe)>1.26Zn-remainder

Properties:

- Zinc is a blue to gray metallic element
- Relatively low melting point
- Good resistance to atmospheric corrosion
- Solubility in copper

Compiled by
Dr. Arbind Prasad
Assistant Professor(Mech. Engg.)
Katihar Engineering College,Katihar
Bihar, India-854109

- Inherent ductility and malleability
- Thermal conductivity

Application:

- Stampings
- Die casting
- Anodes for electro-galvanizing
- Coating on steel
- Making different alloys
- Fabricated and rolled shapes
- Shells for dry batteries
- Building material
- Engravers plates
- Wire for metalizing
- Lithographers sheets

Q.3.Explain the lead alloys with composition properties and uses?

Ans: Lead –antimony alloy

Composition: Antimony 6to 8 lead-rest.

Properties:

- (i)It has highly resistance to sulphuric acid.
- (ii)High tensile strength of about 470kg/cm^2
- (iii)High elongation of 22%

Uses: Storage-battery plates

- Cable sheeting
- Collapsible
- Lead-tin alloy

Type metal composition: Pb=75%,Sb=20%,Sn=5%

Properties: It gives good casting.

Uses: It is used for producing printer type.

Soft solder

- Composition: Pb=37-67%,Sb=31-60%,Sn=0.12-0%

They melt at low temperature and uses for soldering electrical connection and joining lead pipers.

Wood s metal

- Composition:Bi=50%,pb=25%,Sn=12.5%,cd=12.5%

It is read by fusible (m.pt-70°) and used for making fire-alarm, shaft plugs for cookers,milk pot,boiler and selective fuses etc.

Q.4.Write the composition and application of muntz and phosphor bronze?

Ans: Muntz metal:

- Composition:Cu=60%,Zn=40%
- Application: Application of muntz metal are as:
- Slip heating
- Valve stems
- Architectural work etc.
- Perforated metal
- Condenser tubes
- Phosphor bronze
- Low –phosphorus bronzer
  - Composition: Cu=rest, Sn=0.7%,P=up to 0.4%

Application:

- _ Spindles for valves and pumps
- -Boiler fitting and sheets
- -Bearing plates
- High phosphorus bronze;
  - Composition: Cu=rest. Sn=10-13%, P=0.4 to1%

Application: It is used for making

- Bearing and gears
- Taps, bushes
- Spring
- Turbine blades
- Fibers for moving coil galvanometer, fuses etc.

Compiled by
Dr. Arbind Prasad
Assistant Professor(Mech. Engg.)
Katihar Engineering College,Katihar
Bihar, India-854109

Q.5.Describe various types of surface hardening method?

Ans: Induction hardening:

The purpose of induction or flame hardening is to obtain hard and wear resistance surface whilst the cone remains soft, the processes of induction hardening and flame hardening direr from each other in the way of heating.

- In process of induction hardening a high frequency current of about 1000 to 10,000 cycles per second is passed through a copper inductor block which acts as a primary coil of the transformer heating by high frequency current is accomplished by thermal effect of the current induced in the article being heated. The latter is placed in an alternating magnetic field set by the high frequency current. The part to be heated or several turns of copper tube or bus bar. When alternating current is passed through turns of copper tube or bus bar. when alternating current is passed through the inductor, it sets up a magnetic field the intensity of which varies periodically in magnitude and direction. The alternating magnetic line pass through face of article being heated in the inductor and induce the surface an alternating current of same frequency but reversed in direction. This alternating current produces heating effect on the surface and temperature produce is of the order of 750 to 800°c for plain carbon and alloy steel. The heating areas are then quenched immediately by sprays of water delivered through numerous small holes in the inductor block. The part should have carbon content of about 0.75% for this method.
- The induction hardening is at present extensive used for producing hard-surfaces on crack-shafts, car shaft, axles and gears.

Advantage:

- The time required for this heat-treatment operation is less thereby increasing the labor productivity.
- Deformation due to heat treatment is considerable reduces.
- The article which are induction heated have no scale effort.
- The hardening of the surface can be easily controlled by controlling the current.
- The depth of hardness can be easily controlled by varying the frequency of supply voltage.

Flame hardening:

Any carbon steel carrying above 0.3% carbon can be surface hardened by method.

- In flame hardening a high intensity of oxy-acetylene flame is used to heat the surface or area to be hardened to above its critical range, so that austenite is formed, and then the hot surface is quenched to attain the desired hardness.
- This may be followed by tempering if required because of the flame the heating is very quick and is confined only to the surface and is localized to only a limited area. Also, the water spray(quenchy) immediately follows the flame.
- These two factors lead to a very slow and limited heat transfer to remaining part of the component, leaving the lattice free of any appreciable change. Depending upon the type of steel, if air quenching is required, a compressed air jet may replace the water spray.
- Also if the desired surface properties required tempering after flame hardening a low temperature flame follows the quenching spray to reheat the surface to tempering temperature, followed by tempering quench.
- This process is quite flexible because the rate and depth of heating both can be varied according to the requirement. The process can be performed manually or can be made fully automatic., inducing computer controlled.

Laser beam hardening:

- This process is also used for surface hardening of medium carbon and high carbon steels. In this process the job surfaces to be harden is first coated with an absorptive media as zinc or

manganese phosphate, a laser beam is then used and the coated surface is scanned with it.

- The beam size, the scanning speed and the intensity of beam are chosen according to the results desired. The absorptive coating applied on the surface helps in accelerating the conversion of light energy in to heat. Soon after the scanning is over it is followed by water quenching or oil quenching.
- Since there is no addition of carbon from outside the degree of hardness attained by the surface will mainly depend upon carbon content of material. The main advantage hardening, almost negligible distortion can be fully automatic and even computer controlled.

Compiled by
Dr. Arbind Prasad
Assistant Professor(Mech. Engg.)
Katihar Engineering College,Katihar
Bihar, India-854109

Electron beam hardening:

- Its application is limited to only smaller and medium size components because of constraints imposed by the size of the vacuum chamber in which the component if to be housed
- In operation the process is almost similar to laser beam process except that here a high energy electron beam replaces the laser beam as a heating surface.
- Electromagnetic controls are employed for directing and focusing the charged electrons on to the surface to be hardened.the component is enclosed in a high vacuum chamber and has to be manipulated in vacuum only.
- It is essential because the electron cannot travel in the directed path in air.
- This process can be easily automated.

Compiled by
Dr. Arbind Prasad
Assistant Professor(Mech. Engg.)
Katihar Engineering College,Katihar
Bihar, India-854109