

3.3 ALLOYS

INTRODUCTION:

A metal that is normally very soft and malleable, such as aluminium, can be altered by alloying it with another soft metal, like copper. Although both metals are very soft and ductile, the resulting aluminium alloy will be much harder and stronger. Gold when combined with copper becomes suitable to make jewels.

The melting point of Lead is 327°C . The melting point of tin is 231°C . Solder is an alloy of tin and lead. The melting point of solder is 183°C . The low melting point of this alloy is made use of in electrical connections.

The mechanical properties will often be quite different from those of its individual constituents. Hence alloys play an important role in engineering materials.

Alloy

Alloys are homogeneous mixture of two or more metals.

Eg. Brass, Bronze, Stainless steel.

Generally, alloys are prepared by fusing together the different ingredients (metals) in a furnace. The alloys exhibit different properties when compared with the properties of metals in them.

Purpose of alloying

1. To increase the hardness of the metal.
2. To increase the tensile strength of the metal.
3. To make it corrosion resistant.
4. To enhance the malleability and ductility.
5. To get attractive surface and appearance.
6. To make it abrasion resistant.
7. The machinability of the metal can be improved.
8. Melting point of the metal can be decreased.
9. The colour and metallic luster can be improved.

Types of alloys

Alloys are classified into two types.

1. Ferrous alloys
2. Non-ferrous alloys

Ferrous alloys

Alloys which contain containing iron as the main (major) constituent are called as ferrous alloys.

Examples: Stainless steel, chromium steel and vanadium steel.

Sl. No.	Name of the alloy	Composition	Uses
1	Stainless steel	Chromium = 14% Nickel = 1% Carbon = 1% Iron = 84%	1. Used for making kitchen utensils. 2. Used for making surgical instruments 3. Used for making automobile parts
2	Chromium steel	Chromium = 0.5-18% Carbon = 0.15 - 1.3% Iron = 80.7 - 99.35%	1. Used for making rock cutting machines 2. Used for making files 3. Used for making ball bearings 4. Used for making connecting rods
3	Vanadium steel	Vanadium = 0.5% Chromium = 1.1 - 1.5% Carbon = 0.4 - 0.5% Iron = 97.5 - 98%	1. Used for making gears and bearings 2. Used for making axles 3. Used for making springs and pistons

Non-ferrous alloys

Alloys which do not contain containing iron as the main constituent are called as non-ferrous alloys.

Examples: Nichrome, Dutch metal, German silver, gun metal and duralumin

Sl. No.	Name of the alloy	Composition	Uses
1	Nichrome	Nickel = 60% Chromium = 12% Manganese = 02% Iron = 26%	1. Used in making resistance coils 2. Used for making heating elements in stoves, electric irons, water heater and toasters

2	Dutch metal	Copper = 80% Zinc = 20%	1.Used for making cheap jewellery 2.Used for making musical instruments 3.Used for making battery caps 4.Used for making flexible hoses
3	German silver	Copper = 50% Nickel = 30% Zinc = 20%	1.Used for making coins 2.Used for making ornaments 3.Used for making decorative materials
4	Gun metal	Copper = 88% Tin = 10% Zinc = 02%	1.Used for making bearings 2.Used for making coins 3.Used for making hydraulic Fittings 4.Used in foundry works
5	Duralumin	Aluminium = 95% Copper = 04% Magnesium = 0.5% Manganese = 0.5%	1.Used in building aircrafts 2.Used for making automobile parts and locomotive parts 3.Used for making surgical instruments 4.Used for making cables

Summary

In this lesson, the importance of alloying, composition and uses of ferrous alloys and non-ferrous alloys are discussed.

QUESTIONS

PART – A

1. What are alloys?
2. What are the two types of alloys?
3. Give the composition of Stainless steel.
4. Give the composition of Chromium steel.
5. Give the composition of Vanadium steel.
6. Give the composition of Nichrome.
7. Give the composition of Dutch metal.
8. Give the composition of German silver.
9. Give the composition of Gun metal.
10. Give the composition of Duralumin.

PART – B

1. What are ferrous alloys? Give examples.
2. What are non-ferrous alloys? Give examples.
3. Give the composition and uses of Stainless steel.
4. Give the composition and uses of Chromium steel.
5. Give the composition and uses of Vanadium steel.

6. Give the composition and uses of Nichrome.
7. Give the composition and uses of Dutch metal.
8. Give the composition and uses of German silver.
9. Give the composition and uses of Gun metal.
10. Give the composition and uses of Duralumin.

PART – C

1. What are alloys? How are they classified? Give examples.
2. Explain the purposes of alloying.
3. Write a note on the following ferrous alloys.
 - a. Stainless steel
 - b. Chromium steel
 - c. Vanadium steel
4. Write a note on the following non-ferrous alloys.
 - a. Nichrome
 - b. Dutch metal
 - c. German silver
 - d. Gun metal
 - e. Duralumin

TEST YOUR UNDERSTANDING

What are the alloys used in aircraft parts and automobile parts?