EXTRACTION OF COPPER

Copper is a less reactive metal. It is stable in air and can also be found in the free metallic form. It occurs mainly as the sulphide ore, copper pyrite, CuFeS\(_2\). Other forms in which copper occurs in the impure forms are:

- Chalcocite Cu\(_2\)S
- Cuprite Cu\(_2\)O
- Malachite Cu\(_2\)CO\(_3\)(OH)\(_2\) - [CuCO\(_3\).CuO.H\(_2\)O]

Copper is extracted from its sulphide ore, CuFeS\(_2\). The ore is first concentrated by froth flotation in which air is blown into a large tank containing a mixture of crushed ore and water to remove earthly materials.

The clean sulphide is then roasted in limited supply of air and the iron and some of the Sulphur is removed.

\[2\text{CuFeS}_2 + 4\text{O}_2 \rightarrow \text{Cu}_2\text{S} + 2\text{FeO} + 3\text{SO}_2\]

Silicon (iv) oxide is added in the absence of air and heated. This removes the iron (ii) oxide in the form of iron (ii) trioxosilicate (iv) [slag]. The slag can be easily removed as it floats on top of the copper (i) sulphide.

\[\text{FeO} + \text{SiO}_2 \rightarrow \text{FeSiO}_3\]

The copper (i) sulphide is heated in a regulated supply of air to produce copper.

\[\text{Cu}_2\text{S} + \text{O}_2 \rightarrow 2\text{Cu} + \text{SO}_2\]

Further purification is effected by electrolysis of a copper (ii) salt using impure copper as the anode and the pure copper as the cathode.

PROPERTIES OF COPPER

Copper is a reddish brown, soft metal with a characteristic lustre. It is malleable and ductile, it has relatively high tensile strength, it is a good conductor of heat and electricity. It has a melting point of 108°C and relative density of 8.95g/cm\(^3\).

Chemical properties

1. With air
   - Copper is stable in dry air; but in moist air when exposed for a long for a long time it forms a green coating of basic copper (ii) tetraoxosulphate (vi) and copper (ii) hydroxide. CuSO\(_4\).3Cu(OH)\(_2\)
   - When heated in air copper is readily oxidized to black copper (ii) oxide.
     \[2\text{Cu} + \text{O}_2 \rightarrow 2\text{CuO}\]
2. **With acids**
   - Copper is unreactive with hydrochloric acid at any concentration
   - Copper reacts with hot concentrated H\textsubscript{2}SO\textsubscript{4} and is oxidized to copper (ii) tetraoxosulphate (vi)
     \[
     \text{Cu} + 2\text{H}_2\text{SO}_4 \rightarrow \text{CuSO}_4 + 2\text{H}_2\text{O} + \text{SO}_2
     \]
   - Copper reacts with hot conc. HNO\textsubscript{3} to produce nitrogen (iv) oxide and with dilute HNO\textsubscript{3} nitrogen (ii) oxide is produced.
     \[
     \text{Cu} + 4\text{HNO}_3 \rightarrow \text{Cu(NO}_3)_2 + 2\text{H}_2\text{O} + 2\text{NO}_2
     \]
     \[
     3\text{Cu} + 8\text{HNO}_3 \rightarrow 3\text{Cu(NO}_3)_2 + 4\text{H}_2\text{O} + 2\text{NO}
     \]
3. **With halogens, halides are formed**
   - \[
   2\text{Cu} + \text{Cl}_2 \rightarrow 2\text{CuCl} \text{ (excess chlorine)}
   \]
   - \[
   \text{Cu} + \text{Cl}_2 \rightarrow \text{CuCl}_2 \text{ (limited chlorine)}
   \]
4. **Red hot Copper reacts with Sulphur vapour to form copper (i) sulphide.**
   \[
   \text{Cu} + \text{S} \rightarrow \text{Cu}_2\text{S}
   \]

**Uses of Copper**

1. Copper is used in the manufacture of electrical wires because it is a good conductor of electricity
2. Copper is used as ornaments because it is lustrous, malleable, ductile and relatively unreactive in air.
3. Copper is used in making cooking utensils being corrosion resistant
4. Copper is used in combination with other elements e.g zinc to form alloys. [Brass: 80% Cu and 20% Zn].