Soldering, Brazing & Welding

SOLDERING: Soldering is a method of uniting two metal pieces using an alloy by the application of heat

Soft Solder: It is an alloy of lead & Tin. The melting temperature of soft solder will be b/w 150 & 350°C.

Hard Solder: An alloy of copper, tin & silver is known as hard solder & is used for stronger joints. The soldering temperature of hard solders ranges from 600-900°C

Flux: To clean the joint surfaces & to prevent the oxidation, flux is used. Zinc chloride is the commonly used flux in soft soldering.

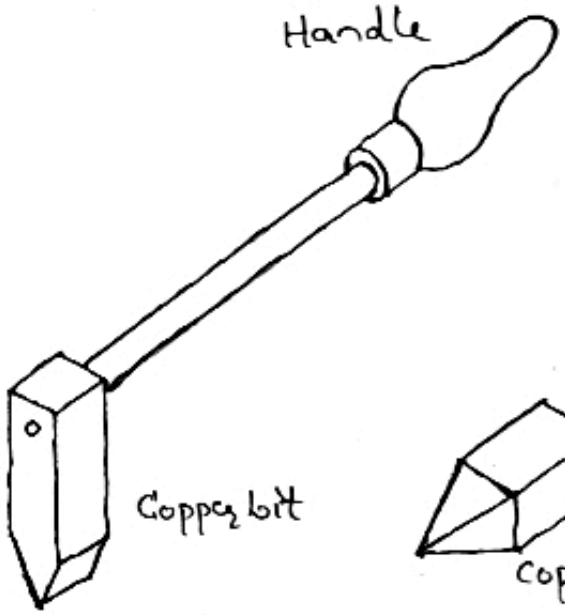
Forms of solder: Solders are available in the form of bars & sticks & in wired forms.

Soldering iron: {Explain about soldering irons}

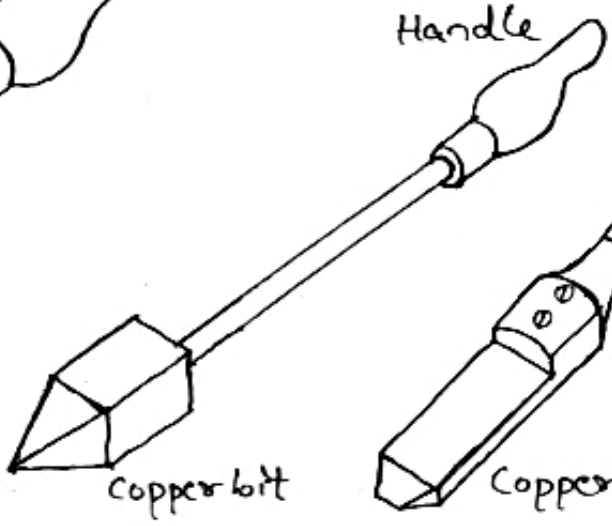
The widely used soldering irons are hand soldering iron & electrical soldering iron.

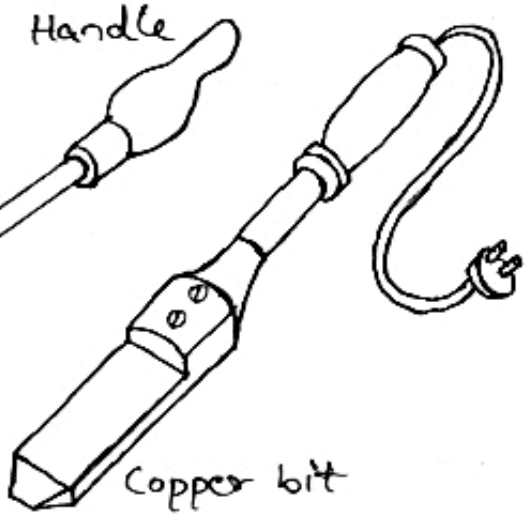
A hand soldering iron consists of a copper bit screwed to a steel rod with a wooden handle at the end. The copper bit of the soldering iron is heated in an open flame & used to transfer heat to metal being soldered & to melt the solder.

In electrical soldering iron, a heating coil heats the bit. It heats the joints uniformly at a constant temperature.



Hand Soldering Iron





Electrical Soldering Iron

Soldering procedure :

1. clean the metal surfaces thoroughly with an emery cloth.
2. Fit the pieces to be soldered with a narrow gap & clamp securely.
3. Apply a suitable flux to the metal being soldered.
4. Heat the metal surface by making contact with the hot soldering iron. When the joint reaches the melting point of the solder, apply the solder to the iron & move it along the joint.
5. leave the pieces clamped until the solder cools.

Advantages of soldering

1. It is a simple & Economical process.
2. Since it is done at relatively low temperatures, no metallurgical damage to the base metal.
3. The soft soldered joints can be easily dismantled by simple heating.

Disadvantages of Soldering

1. The strength of the soldered joint is relatively low.
2. Flux must be thoroughly cleaned off after soldering as it is often corrosive.

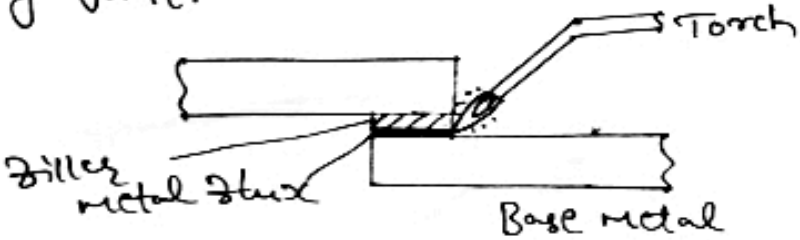
BRAZING { Write a note on brazing }

Brazing is a process of joining two metal pieces by the addition of non-ferrous filler metal with melting temperature above 450°C.

* Copper & Copper alloys, Silver & Silver alloys are the most commonly used filler metals for brazing.

Brazing procedure:

1. The surface to be joined must be cleaned first by removing grease & oxide.
2. After cleaning a flux is applied at the place of joint. Common borax & mixtures of borax & boric acid are used as a flux.
3. The joint & filler material are heated by an oxy-acetylene welding torch to the temperatures above the melting temperature of filler material.
4. The molten filler material flows by capillary action into the joint space & after cooling produces a strong joint.



Advantages of Brazing

1. Dissimilar metals can be joined easily.
2. Strong joint can be obtained by brazing than soldering.
3. properly brazed joints are pressure tight.
4. It is an economical & quick process.
5. Less heating is required than for welding.

Disadvantages :

1. Brazing the heavy section may be difficult.
2. Flux must be thoroughly cleaned off after brazing, as it is often corrosive.

* Difference b/w brazing & Soldering

Brazing	Soldering
1. melting point of filler material is above 450°C	1. melting point of filler material is below 450°C
2. Dissimilar metals can be joined easily	2. only similar metals can be joined.
3. Good surface finish	3. Does not yield a good surface finish
4. Stronger joints	4. Less stronger joints.
5. The filler material is called spelter	5. The filler material is called solder

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Difference b/w welding, Brazing, and Soldering.

Sl no	parameter,	welding	Brazing	Soldering
1	Temperature	Very High, about more than 5000°C	Melting point of the filler metal is above 450°	Melting point of the filler metal is below 450°C
2	Type of Metal to be Joine	only Similar Metals	Dissimilar Metals	only Similar Metals
3	Surface finish	Moderate	Good	poor
4	Strength	very High	High	weak.
5.	Filler material	Filler material used is made of same material as that of the base metal	Filler material used is not same as that of base metal	
6.	Heat affected zone	The metal adjacent to the weld portion called Heat affected zone is affected to a large extent	Heat affected zone is moderate	Heat affected zone is almost negligible since the process is carried out at low temp.

WELDING

Welding is the process of joining two pieces of metals by the application of heat & with (or) without the application of pressure and filler material. Welding produces a permanent fastening [Joining]

Applications (or) uses of welding

1) Welding is used in making bridges & buildings.
2) The large & small pressure vessels and tanks are usually welded.
3) The automobile, aircraft, railway & ship building industries use large amounts of welding.
4) Machine bases, frames, brackets, bearing supports are often designed as weldments.
5) Welding is extensively used in the fabrication work in which metal plates, rolled steel sections, castings of ferrous materials are joined together.
6) It is also used for repairing broken, worn-out, (or) defective metal parts.

Types of Welding

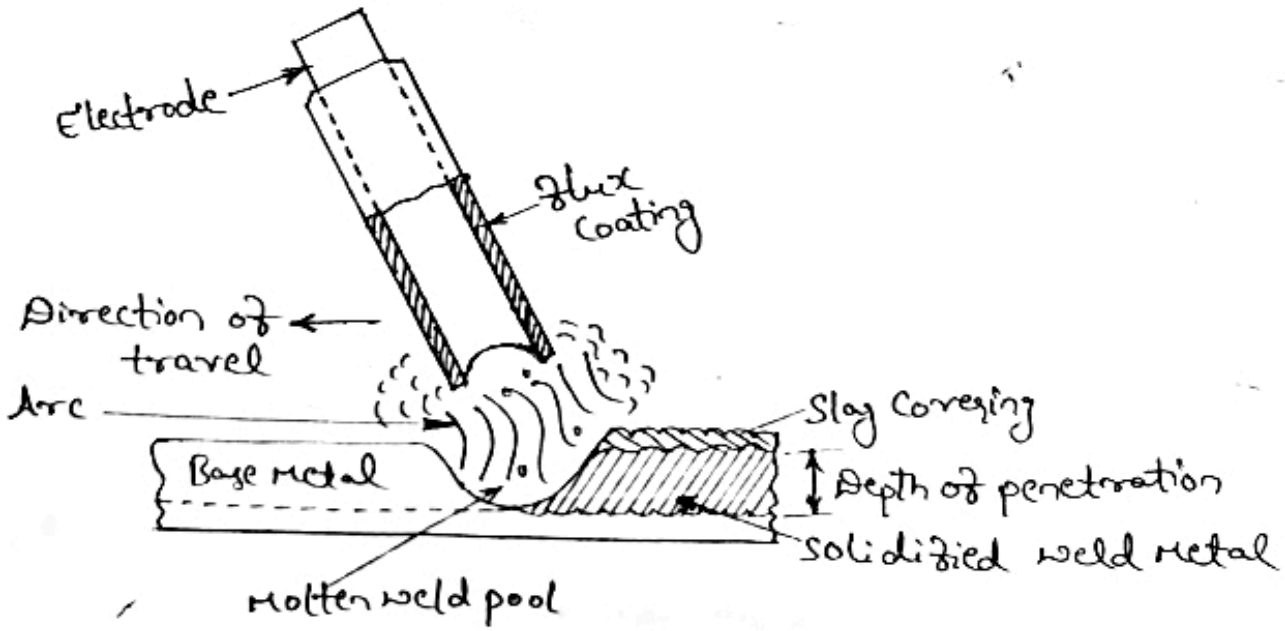
Welding process may be classified based on the basic principles employed as

i) pressure welding (or) plastic welding
ii) Fusion welding (or) Non-pressure welding

plastic welding : In plastic welding the metal pieces to be joined are heated to a plastic state & then joined together by the application of external pressure without the addition of filler material. The different types of plastic (or) pressure welding are i) Forge welding
ii) Resistance welding
iii) Thermit welding
iv)

Fusion welding : In fusion welding the metal pieces are heated to molten state at the joint & allowed to solidify without the application of pressure. A filler material is used during the welding process.
The different types of fusion welding are i) Arc welding
ii) Gas welding etc

ARC WELDING :

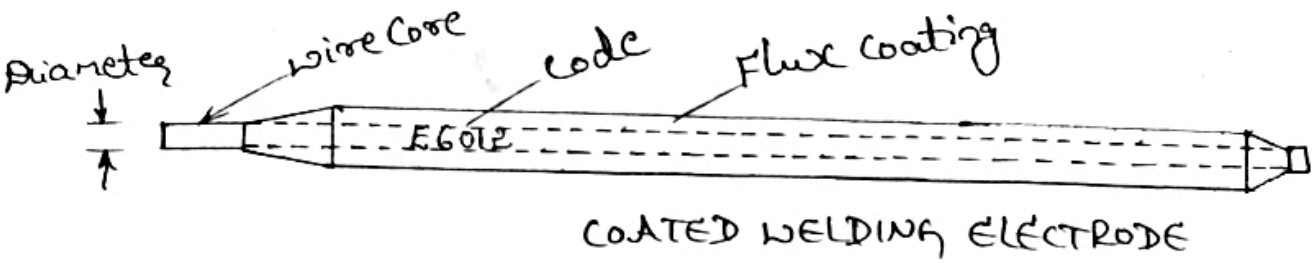


Cut away view of the arc welding with a coated electrode

The principle of arc welding is as follows. When two conductors of an electric circuit are touched together momentarily & then instantaneously separated slightly, assuming that there is sufficient voltage in the circuit to maintain the flow of current an electric arc is formed. Concentrated heat is produced throughout the length of the arc at a temperature of about 5000 to 6000°C. In arc welding usually the parts to be welded are wired as one pole of the circuit & the electrode held by the operator forms the other pole. When the arc is produced, the intense heat quickly melts the workpiece metal forming a small molten pool. At the same time the tip of the electrode at the arc also melts & this molten metal of the electrode is carried over by the arc to the molten metal pool of the workpiece. The molten metal in the pool is agitated by the action of arc, throughly mixing the base & the filler metal. A solid joint will be formed when the molten metal cools & solidifies. The flux coating over the electrode produces an inert gaseous shield surrounding the arc & protects the molten metal from oxidising.

Arc welding electrodes:

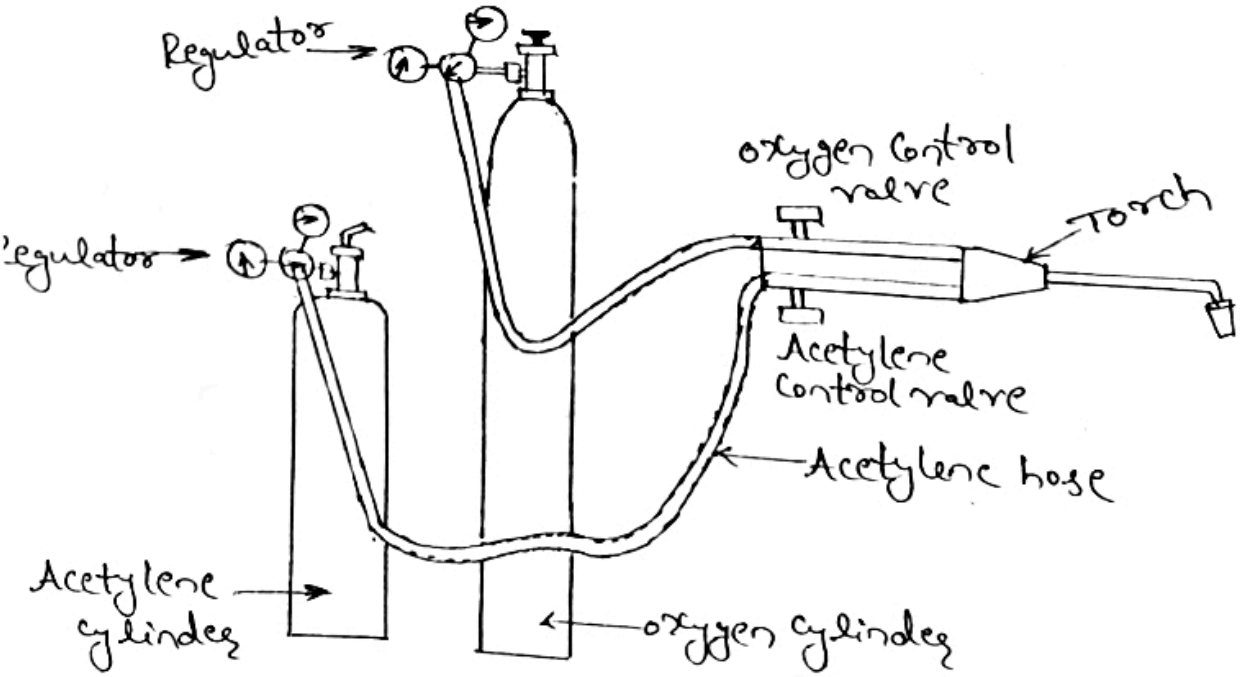
Electrode is a filler metal in the form of a wire (or) rod either bare (or) coated through which current is conducted to the electrode holder & the arc. Bare electrodes have limited use for welding wrought iron & low (or) medium carbon steel. They are used as filler metals in various welding operations. The coated electrodes are the most important ones used in commercial welding. Electrodes are coated with materials that include silicate binders, oxides carbonates, flourides, metal alloys etc.



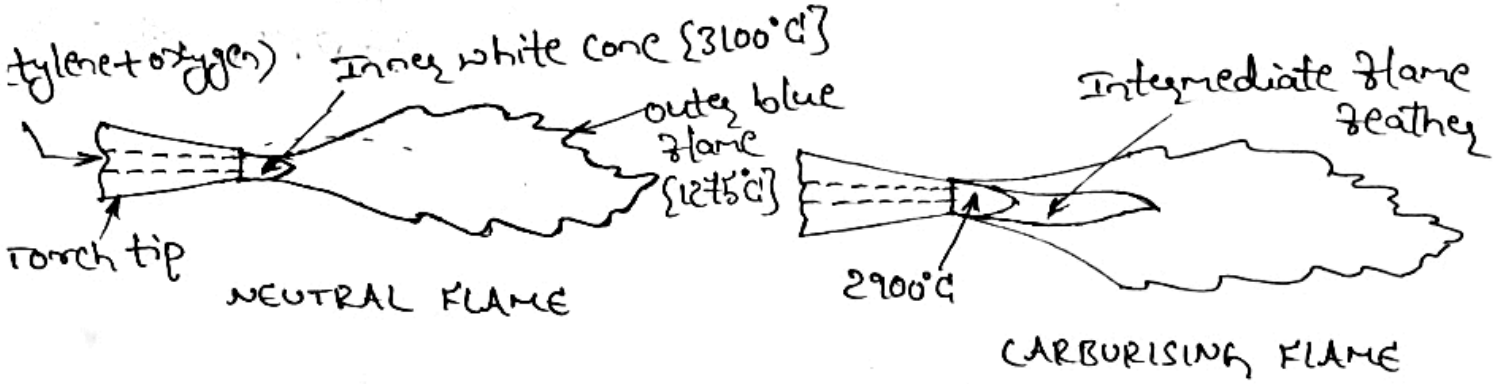
COATED WELDING ELECTRODE

GAS WELDING : Gas welding is a fusion method of welding in which a strong gas flame is used to ~~[illegible]~~ raise the temperature of the workpiece so as to melt them. The gases that can be used for heating are i) oxygen & acetylene mixture & ii) oxygen & Hydrogen mixture. The oxy-acetylene gas mixture is most commonly used in gas welding.

I Gas welding Equipment : The oxy-acetylene gas equipment consists of two large steel cylinders, one containing oxygen at high pressure & the other dissolved acetylene also at high pressure, rubber tubes, pressure regulators, & blow torch. The oxygen & acetylene are supplied to the blow torch separately where both of them get mixed & comes out through the nozzle of the blow torch.



Gas Flame : For the Complete Combustion of the acetylene, 2.5 volumes of oxygen are required for 1 volume of acetylene. In practice however ratio of the parts of oxygen to the parts of the acetylene, referred as gas ratio varies from 0.95 to 1.5. Depending on the gas rati neutral, oxidising & carburising (or) reducing flames are obtained as shown.



{DIFFERENT TYPES OF OXY-ACETYLENE WELDING FLAMES}

A neutral flame is obtained by supplying equal volumes of oxygen & acetylene. The neutral flame consists of an inner small whitish cone surrounded by a sharply defined blue flame. Most of the oxy-acetylene welding is done with the use of neutral flame.

A carburising (or) a reducing flame is obtained by supplying an excess acetylene in the gas ratio below 1.95 to 1. It has 3 cones an inner white cone, surrounded by an intermediate whitish cone known as "intermediate flame feather" & a bluish envelope. This flame is generally used for welding alloy steels, Cast iron, aluminium etc

The oxidising flame is obtained when there is an excess oxygen. having gas ratio as high as 1.15 to 1.5. In appearance it resembles a neutral flame. This is used for oxy-acetylene cutting & is not suitable for welding.

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