2.8.7 Filler and Flux material using in Arc welding process

The electrode rod is made of a material that is compatible with the base material being welded and is covered with a flux that protects the weld area from oxidation and contamination by producing CO_2gas during the welding process. The electrode core itself acts as a filler material making separate filler unnecessary. The process is very versatile, requiring little operator training and inexpensive equipment. However, weld times are rather slow, since the consumable electrodes must be frequently replaced and because slag and the residue from the flux must be clipped away after welding. Furthermore, the process is generally limited to welding ferrous materials, though specialty electrodes have made possible the welding of cast iron, nickel, aluminum, copper and other metals. The versatility of the method makes it popular in a number of application including repair work and construction.

2.9 Gas Tungsten Arc Welding (GTAW)

Gas tungsten arc welding is also called TIG welding. In GTAW welding, the electric arc is produced between a non-consumable tungsten electrode and the work piece. There is an electrode holder in which the non-consumable tungsten electrode is fixed when the arc is produced.

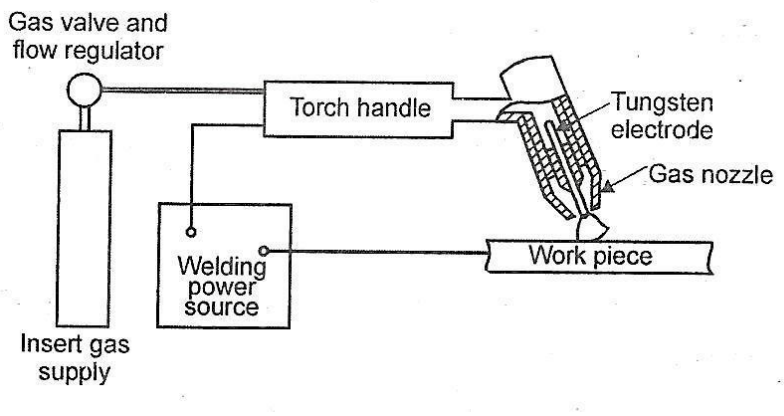

Figure 2.13 Gas Tungsten Arc Welding Equipment

By supplying the electric power between the electrode and the work piece, the insert gas from the cylinder passes through the nozzle of the welding head around the electrode. The insert gas surrounds the arc and protects the weld from atmospheric effects and hence, defect free joints are made.

Filler metal may or may not be used. When a filler metal is used, it is usually fed manually into the weld pool. An electrode used in this process is tungsten. It has high melting point (330°C), therefore, it will not be melted during welding. This process is used for welding steel, aluminum, Cast iron, Magnesium, Stainless steel, Nickel based alloys, copper based alloys and low alloy steel. It is also used for combining the dissimilar metals in hard facing and in surfacing of metals. This process is used for the metals having thickness less than 6.5mm

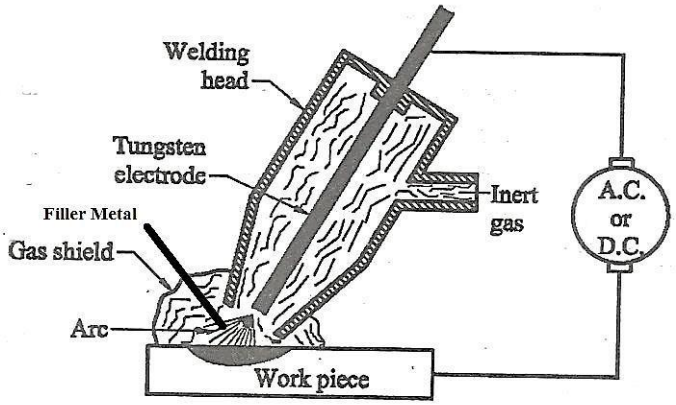

Figure 2.14 Gas Tungsten Arc Welding Process

Advantages

1. No flux is required.
2. The welding speed is high.
3. It can be used for both ferrous and non ferrous metals.
4. It produces high quality weld.
5. No weld cleaning is necessary.
6. The arc and weld pool are clearly visible during welding.

2.10 Gas metal arc welding (GMAW)

The process is also called as metal inert gas welding (MIG). In this arc welding, the electric arc is produced between a consumable metal electrode and the work piece.

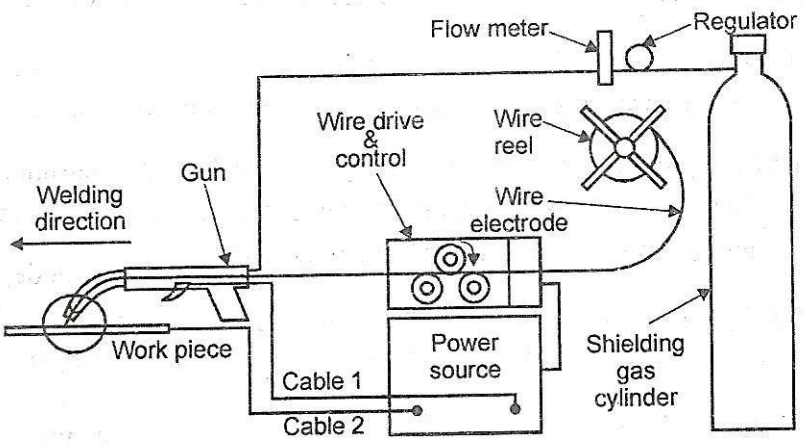

Figure 2.15 Gas metal arc welding Equipment

During welding, the arc and welding zone are surrounded by an inert gas, as show in figure. Argon or Helium is used as the inert gas. The surrounded air protects the weld from atmosphere. The electrode is fed continuously through welding head because during welding the electrode is melted by arc and deposited over the work piece. The welding can be done manually or automatically. Either D.C generator or A.C transformer is used for MIG welding. The current

ranges from 100 to 400 A depending upon the diameter of the wire. The welding head may be either air or water-cooled depending upon the current being used.

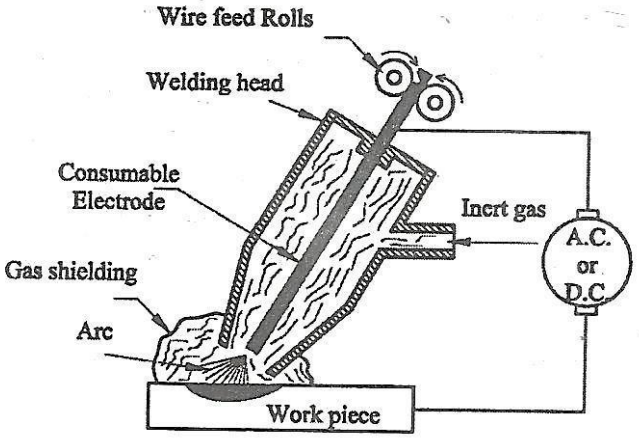

Figure 2.16 Gas metal arc welding Process

This process is used for welding thick plates. It is used for welding aluminum; stainless steel, nickel, and magnesium without weld defects.

Advantages:

1. No flux is required.
2. High welding speed is obtained.
3. It is possible to weld ferrous and non-ferrous metals.
4. It provides greater efficiency
5. It produces high quality weld
6. The process is cheaper

2.11 Submerged arc welding (SAW)

2.11.1 Flux Core

When the flux is required continuously or where the larger quantity of flux has to be supplied, on that time the flux is used in the form of wire wound on a rotating drum or reel called as flux core. It is separately supplied instead of using welding rod along with flux material. Flux is mainly used to avoid oxidation reaction with oxygen present in the atmosphere. If the flux is used along with filler material in the form of coated electrodes, the oxidation reaction may not be completely prevented. In order to avoid oxidation reaction completely, enough quantity of flux should be supplied with a separate control independently with filler material.

E.g. the complete welding setup is dipped in the flux powder named as submerged arc welding.

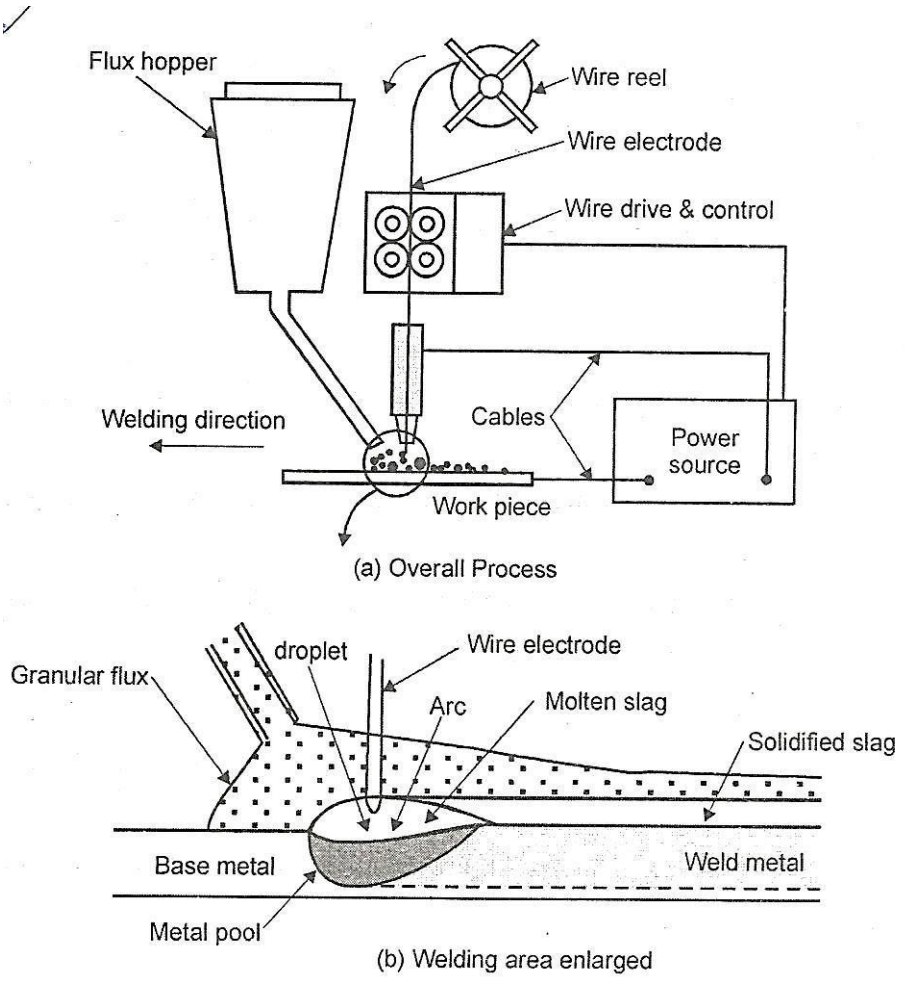

Figure 2.17 Submerged arc welding

Submerged arc welding is also called as sub arc welding or hidden arc welding. In this welding, an electric arc is produced between consumable bare electrode and the work piece. But the arc is completely submerged i.e., hidden under the flux powder. The arc is not visible outside. The metal electrode is continuously fed from the reel by a moving head. The flux powder is fed in front of the moving head. It is supplied from a hopper. When the arc is produced in the welding zone at the end of the electrode and the arc is completely covered by flux powder. So, there will not be any defect in the weld due to atmosphere effects.

The flux powder used here is made up of silica, metal oxides and other compounds fused together and then crushed to the proper size. Another group of fluxes is made of similar material bonded and formed into granules. The flux not only protects the weld surface from atmosphere and also acts as a deoxidiser and scavenger. It may also contain powder metal alloying elements. The flux covers the arc and molten metal. Some of the flux melts and forms the slag on the weld. The unused flux is sucked by a pipe. Voltage used here is 25 to 40V. current used depends on work piece thickness. Normally, D.D. is employed using 600A to 1000A and A.C. is usually 200A.

Since, the flux must cover the joint to be welded. This method is restricted to make straight welds in the flat position. Thus, it is suitable for cylinders, steel pipes etc.

Submerged are welding is used specially for welding carbon steels and alloy steels. It can be used to weld chromium steels and austenitic chromium-nickel steels. Plates of 12 to 50mm can be welded with one pass.

Advantages

1. Very high quality welds are produced.
2. It is a very fast method.
3. Deep penetration can be obtained.
4. Shielding accessory for the eyes is not needed.
5. Long joints can be easily welded.

Disadvantages

1. It is not suitable for welding works which is inclined and vertical.
2. The welding zone is not seen. So, it is difficult to guide the electrode movement.

2.12 Electro Slag Welding (ESW)

Principle

Electro slag is a welding process in which the coalescence is formed by molten slag and molten metal pool remains shielded by the molten slag.

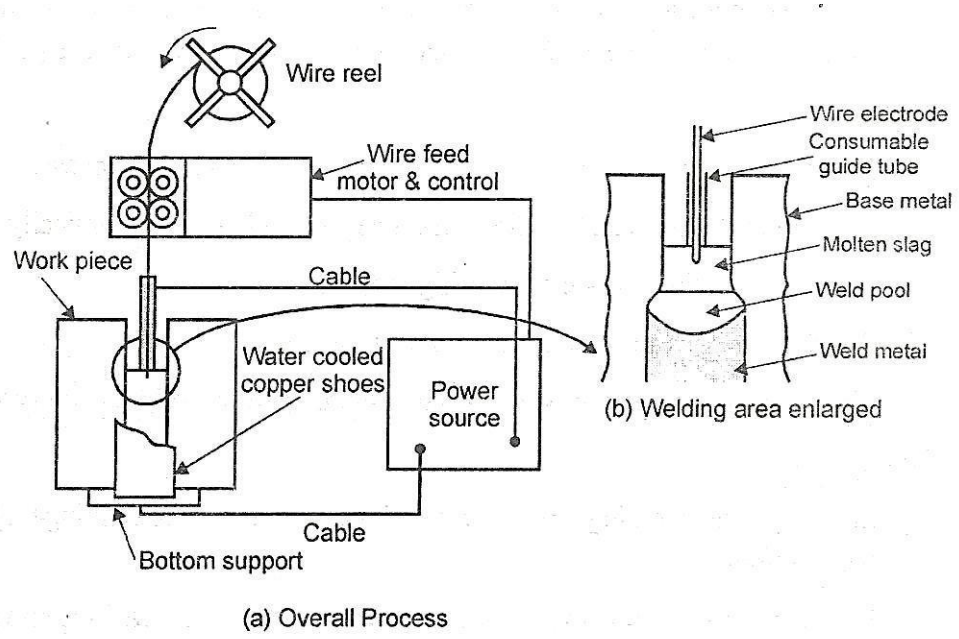

Figure 2.18 Electro Slag Welding Equipment

Working

In this welding process, the electric are is struck between the electrode and work jointed by the use of steel wood. Welding flux is added and melted by the use of heat flux added and further melted by the use of heat from the arc. This action is stopped until the molten slag is

formed and molten slag remains between the electrode and the work. The temperature of this slag remains between 1600 to 1900° C inside surface. So, this high amount of heat energy is enough for melting the work piece and the electrode. Thus, the weld is formed.

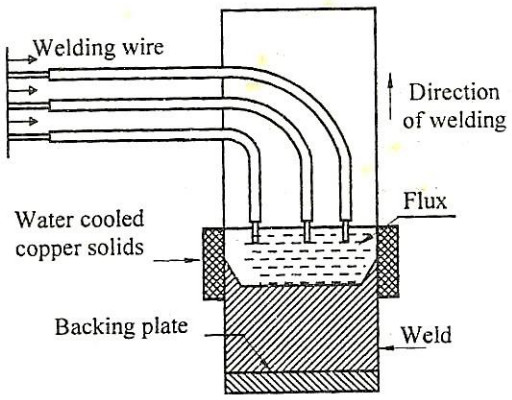

Figure 2.19 Electro Slag Welding process

The electric current passes from the electrode to the work piece through the slag pool. The welding flux used in electro slag welding should be cleared from impurities and oxidation.

Applications

1. It is used for welding carbon steels alloys steels and nickel alloys.
2. Forgings and castings are welded.
3. Heavy plates can be welded.

Advantages

1. Heavy thickness metals can be welded economically.
2. Low stress formation.
3. Preparation of joints is easier.
4. High deposition during the weld.
5. Low distortion.

Disadvantages

1. It is difficult to weld cylindrical objects.
2. Hot cracking may occur.
3. Grain size becomes larger.
4. The cost is high.

2.13 RESISTANCE WELDING

In resistance welding, the parts to be joined are heated to plastic state by their resistance to the flow of electric current and mechanical pressure is applied to complete the weld. In this process, there are two copper electrodes in a circuit of low resistance. The metal parts to be welded are placed between the electrodes. When the current is passed through the electrodes, the electrical resistance at the metal joints becomes very high. So, the metals are brought to red-hot