Shielded metal arc welding process

- An electric arc is generated between a coated electrode and the parent metal
- The coated electrode carries the electric current to form the arc, produces a gas to control the atmosphere and provides filler metal for the weld bead
- Electric current may be AC or DC. If the current is DC, the polarity will affect the weld size and application

Process

- Intense heat at the arc melts the tip of the electrode
- Tiny drops of metal enter the arc stream and are deposited on the parent metal
- As molten metal is deposited, a slag forms over the bead which serves as an insulation against air contaminants during cooling
- After a weld ‘pass’ is allowed the cool, the oxide layer is removed by a chipping hammer and then cleaned with a wirebrush before the next pass.

Submerged arc welding

- Weld arc is shielded by a granular flux, consisting of silica, lime, manganese oxide, calcium fluoride and other compounds.
- Flux is fed into the weld zone by gravity flow through nozzle
• Thick layer of flux covers molten metal
• Flux acts as a thermal insulator, promoting deep penetration of heat into the work piece
• Consumable electrode is a coil of bare round wire fed automatically through a tube
• Power is supplied by 3-phase or 2-phase power lines

![Diagram of welding process]

Fig: Schematic illustration of the submerged-arc welding process and equipment. The unfused flux is recovered and reused.

**Gas metal arc welding**
- GMAW is a metal inert gas welding (MIG)
- Weld area shielded by an effectively inert atmosphere of argon, helium, carbon dioxide, various other gas mixtures
- Metal can be transferred by 3 methods:
  - Spray transfer
  - Globular transfer
  - Short circuiting

**Process capabilities**
- GMAW process is suitable for welding a variety of ferrous and non-ferrous metals
- Process is versatile, rapid, economical, welding productivity is double that of SMAW

**Flux cored arc welding**
- Flux cored arc welding is similar to a gas metal arc welding
- Electrode is tubular in shape and is filled with flux
- Cored electrodes produce more stable arc, improve weld contour and produce better mechanical properties
- Flux is more flexible than others
Electro gas Welding

- EGW is welding the edges of sections vertically in one pass with the pieces placed edge to edge
- Similar to Electro gas welding
- Weld metal is deposited into weld cavity between the two pieces to be joined
- Difference is Arc is started between electrode tip and bottom part of the part to be welded
- Flux added first and then melted by the heat on the arc
- Molten slag reaches the tip of the electrode and the arc is extinguished
- Heat is then continuously produced by electrical resistance of the molten slag
- Single or multiple solid as well as flux-cored electrodes may be used

Process capabilities

- Weld thickness ranges from 12mm to 75mm
- Metals welded are steels, titanium, aluminum alloys
- Applications are construction of bridges, pressure vessels, thick walled and large diameter pipes, storage tanks and ships.