# SHIELDED METAL ARC WELDING

**ME 8351 Manufacturing Technology I**
**Unit -1 Casting and Joining Processes**
**II Year /III Semester**
**Mechanical Engineering**

# ARC WELDING PROCESS

- In shielded metal arc welding (SMAW), an arc between a covered electrode and a weld pool is used to accomplish a weld.
- As the welder steadily feeds the covered electrode into the weld pool, the decomposition of the covering evolves into gases that shield the pool.
- The process is used without application of pressure and with filler metal from the covered electrode.
- The sound weld metal deposited by the process is used for both joining and for applying a functional surface to metal products.

# ARC WELDING EQUIPMENT

- Power source of adequate current rating and duty cycle
- SMAW electrode compatible with the output of the power source
- Suitably sized welding cable
- An electrode holder
- Workpiece lead.

# DESIRED PROPERTIES OF ELECTRODE

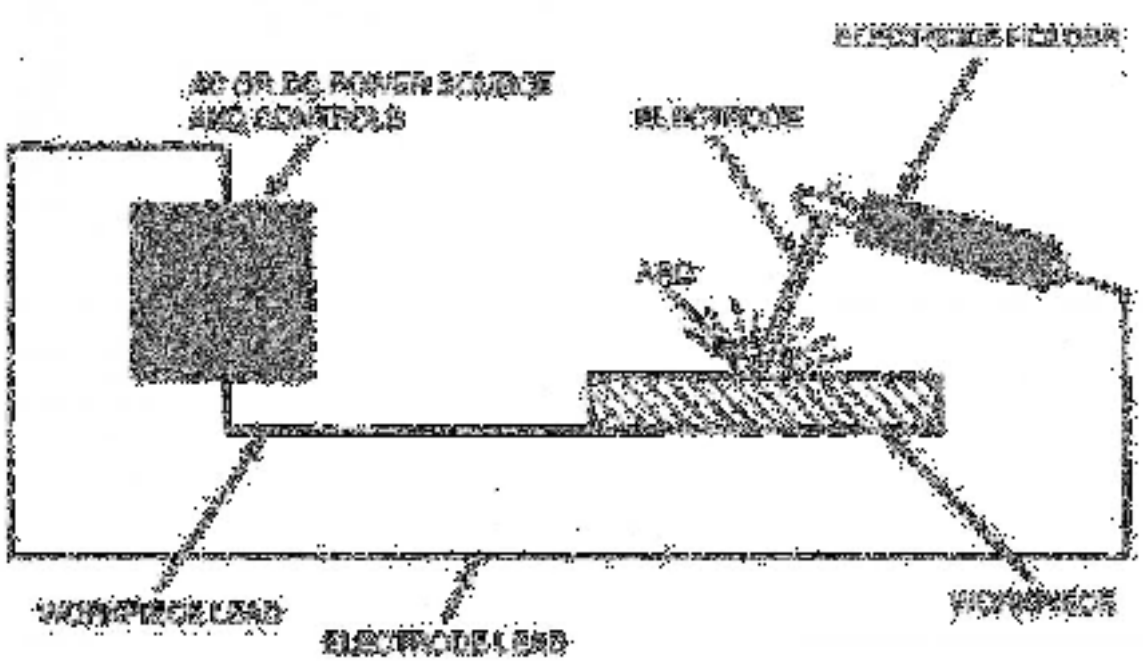
The electrode must meet the following three criteria:

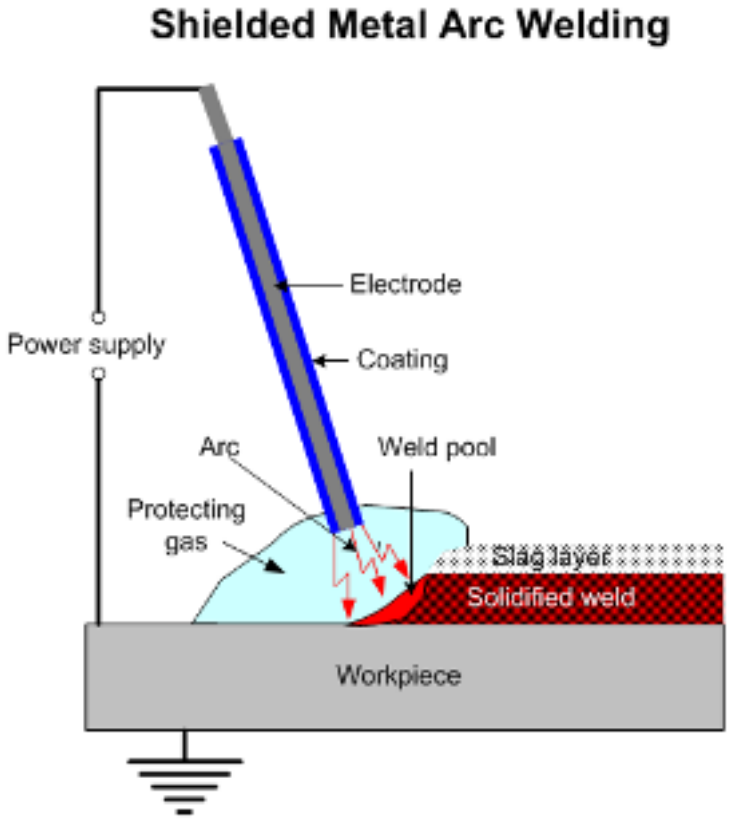
1. It must shield the arc and the weld metal.
2. It must add metal to the weld.
3. It must sustain a welding arc.

The Flux coating must meet the following three criteria:

1. Decompose into gases and displace the air at the weld site, thus providing a shield for the arc and the weld metal
2. Ionize to support the arc plasma
3. Flux the molten metal and, on cooling, form a protective slag cover on the weld bead.

# PRINCIPLE OF OPERATION





# PRINCIPLE OF OPERATION

- Shielded Metal Arc welding employs the heat of the arc to melt the base metal and the tip of a consumable covered electrode. The electrode and the work are part of an electric circuit.
- This circuit begins with the electric power source and includes the welding cables, an electrode holder, a workpiece connection, the workpiece(weldment), and an arc welding electrode.
- One of the two cables from the power source is attached to the work. The other is attached to the electrode holder.

# PRINCIPLE OF OPERATION

- Welding commences when an electric arc is struck by making contact between the tip of the electrode and the work.
- The intense heat of the arc melts the tip of the electrode and the surface of the work close to the arc.
- Tiny globules of molten metal rapidly form on the tip of the electrode, then transfer through the arc stream into the molten weld pool.
- The arc is moved over the work at an appropriate arc length and travel speed, melting and fusing a portion of the base metal and continuously adding filler metal.
- Since the arc is one of the hottest of the commercial sources of heat [temperatures above 9000° F (5000° C) have been measured at its center], melting of the base metal takes place almost instantaneously upon arc initiation.

# ASSESSMENT-1

Arc-welding uses following type of electric supply .....

a. A.C.

b. D.C.

c. Both AC and DC

d. Spiral waveform

Distortion of workpiece in welding occurs due to.....

a. Use of excessive current

b. Improper clamping methods

c. Use of wrong electrodes

d. Oxidation of weld pool

# SELECTING THE TYPE OF CURRENT

DIRECT CURRENT

- It is the most common current choice for stick welding.
- The current flows in one direction only and has many advantages over alternating current for the stick process.

These advantages include:

✓ fewer arc outages

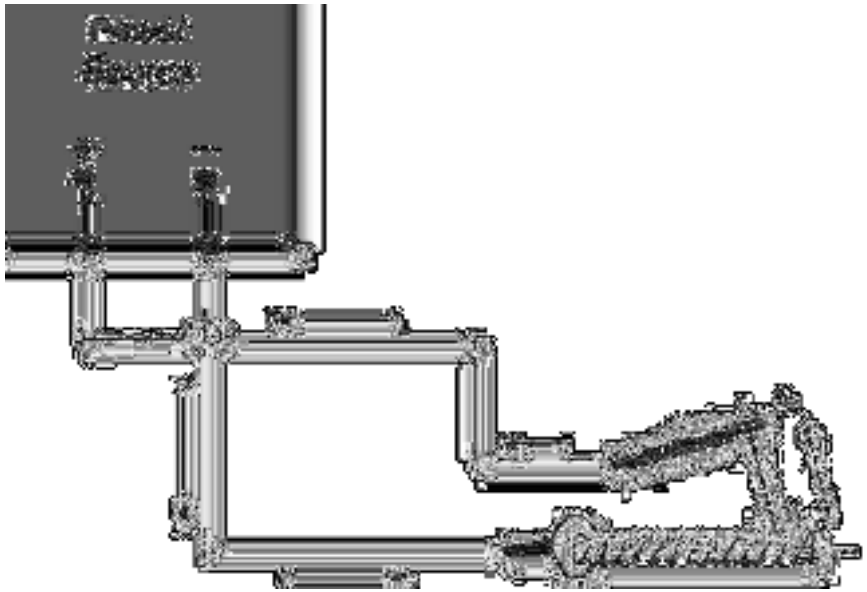
✓ less spatter

✓ easier to start arc

✓ better control in out-of-position welds.

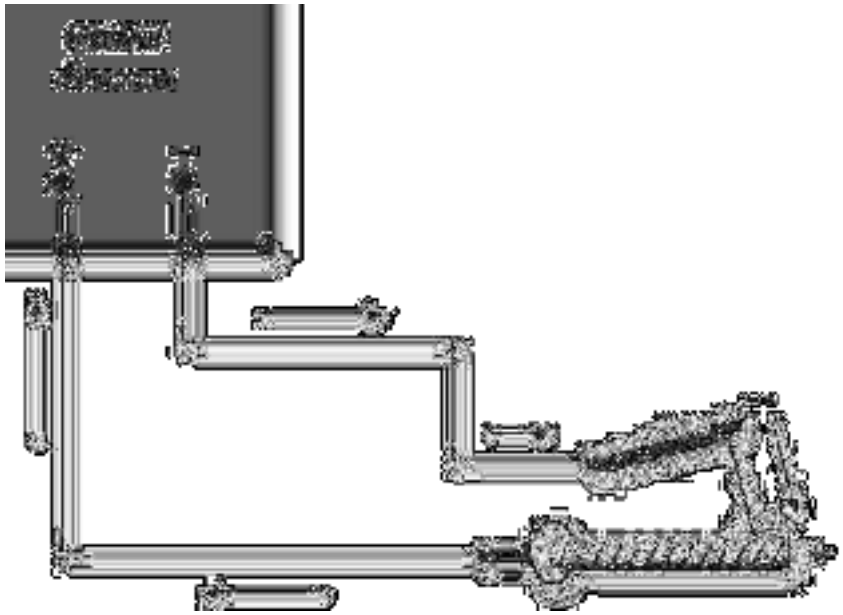
# DIRECT CURRENT ELECTRODE POSITIVE CONNECTION(DCEP) OR REVERSE POLARITY

- For SMAW, the DCEP connection is used most often.
- It provides for the best penetration and bead profile.
- For this reason most electrodes are made to weld with DCEP.



# DIRECT CURRENT ELECTRODE NEGATIVE CONNECTION(DCEN) OR STRAIGHT POLARITY

- Using a DCEN connection for Arc Welding will result in a narrow bead with little penetration.
- This connection works well when welding on sheet metal or for hard surfacing electrodes.



# SELECTING THE TYPE OF CURRENT

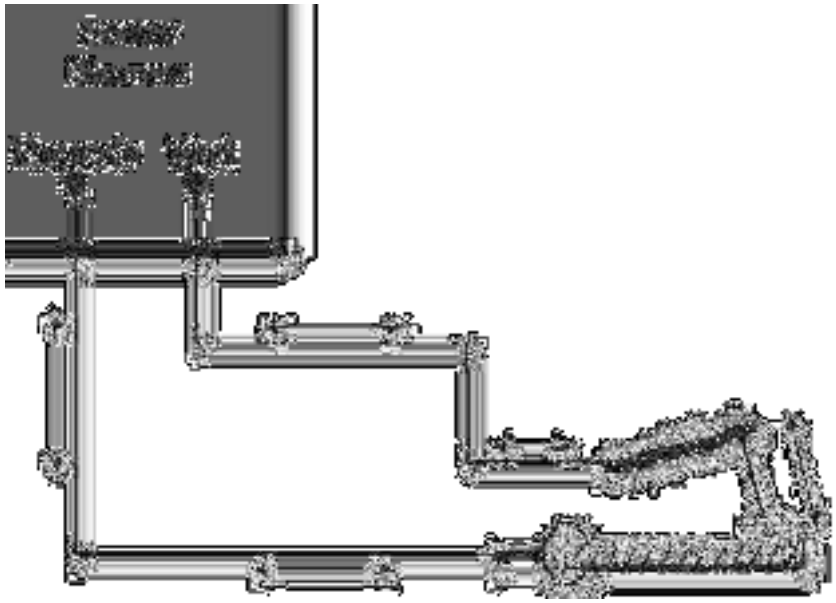
ALTERNATING CURRENT

- Current flows in a specific direction for one half-cycle, stops at the "zero" line, then reverses direction of flow the next half-cycle at regular intervals.
- The AC sine wave represents the current flow as it builds in amount and time in the positive direction and then decreases in value and finally reaches zero.
- The current then reverses direction and polarity reaching a maximum negative value before rising to the zero value.

# SELECTING THE TYPE OF CURRENT

ALTERNATING CURRENT

- An AC only SMAW power source is the most economical type of welding power source available.
- Because of the alternating characteristic of the current, however, the resulting arc and weld will tend to have more spatter, less penetration, and more arc outages than a weld made with direct current.



# ARC WELDING ADVANTAGES

- The equipment is relatively simple, inexpensive, and portable.
- The SMAW electrode provides both the shielding and the filler metal to make a sound weld.
- Auxiliary gas shielding or granular flux is not required.
- The process is less sensitive to wind and draft than the gas shielded arc welding processes.

# ARC WELDING LIMITATIONS

- The process is discontinuous due to limited length of the electrodes;
- Weld may contain slag inclusions;
- Fumes make difficult the process control.

# ASSESSMENT-2

What is the function of flux in shielded metal arc welding?

a) To completely cover the welded zone

b) To prevent oxidation of joint

c) To prevent spattering of molten metal

d) To prevent sticking of molten metal

The deflection of the arc in arc blow occurs due to?

a) Electric field

b) Magnetic field

c) Combination of both

d) Hydrostatic field

# REFERENCES


1. Rao, P.N. "Manufacturing Technology Foundry, Forming and Welding", 4th Edition, TMH-2013.
2. Sharma, P.C., "A Text book of production Technology", S.Chand and Co. Ltd., 2014