Materials Manufacturing (EDPT 601)

Tutorial 5 (Welding)

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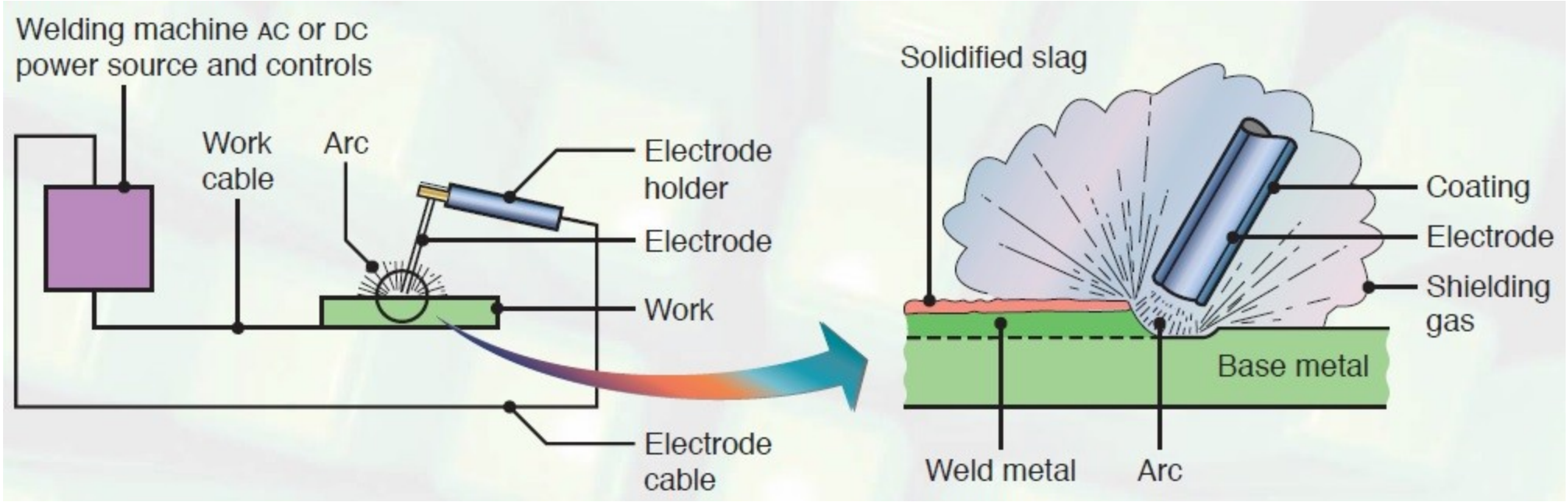
Shielded Metal Arc Welding (SMAW)

➢ Introduction

- One of the oldest and simplest ways of versatile joining processes
- About 50% of the industrial and maintenance is performed by this welding process
- Low cost equipment
- A finite electrode which consists of a metal wire usually from 1.5 to 6.5 mm diameter and 20 to 45 cm length



- **Functions of the wire electrode coating**

1. It vaporize to provide a protective atmosphere (shielding).
2. Acting as flux to deoxidize and remove impurities from molten metal.
3. Adding alloying elements.
4. Adding filler materials.
5. Influence the shape of weld bead.
6. Affect arc penetration.
7. Provide ionizing elements to help stabilizing the arc.
8. Reduce weld metal spatter and increase efficiency of deposition.

- **Main Applications**

1. Useful for work in remote areas where portable fuel- powered generator can be used for power supply.
2. General construction.
3. Ship building.
4. Pipe lines.
5. Maintenance work.

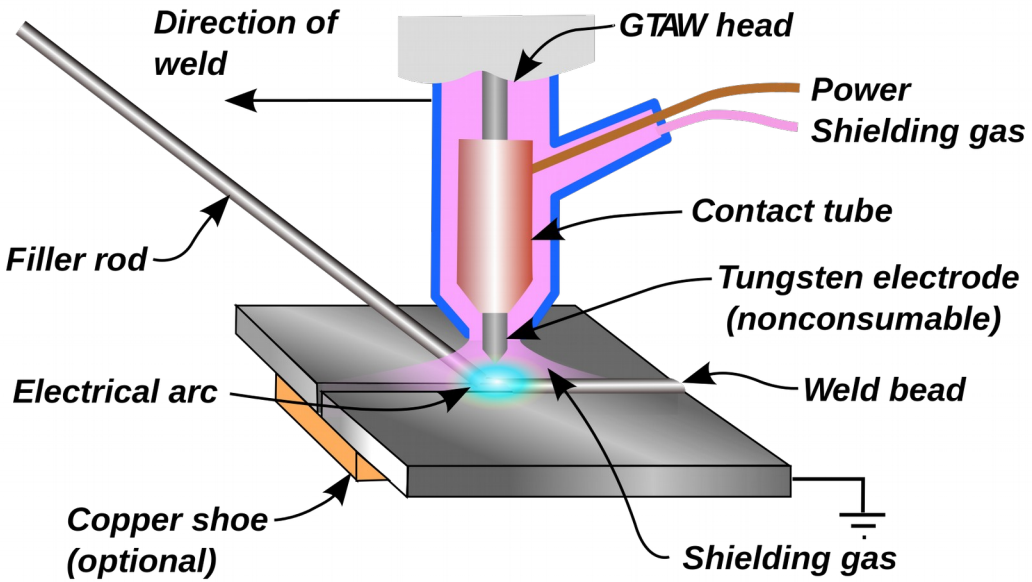
Gas Tungsten Arc Welding (GTAW)
Tungsten Inert Gas (TIG)

➢ Introduction

- Gas tungsten arc welding (GTAW), also known as tungsten inert gas (TIG) welding, is an arc welding process that uses a non-consumable tungsten electrode to produce the weld.
- The weld area and electrode is protected from oxidation or other atmospheric contamination by an inert shielding gas (argon or helium).
- A filler metal is normally used, though some welds, known as autogenous welds, do not require it.

➢ Main Applications

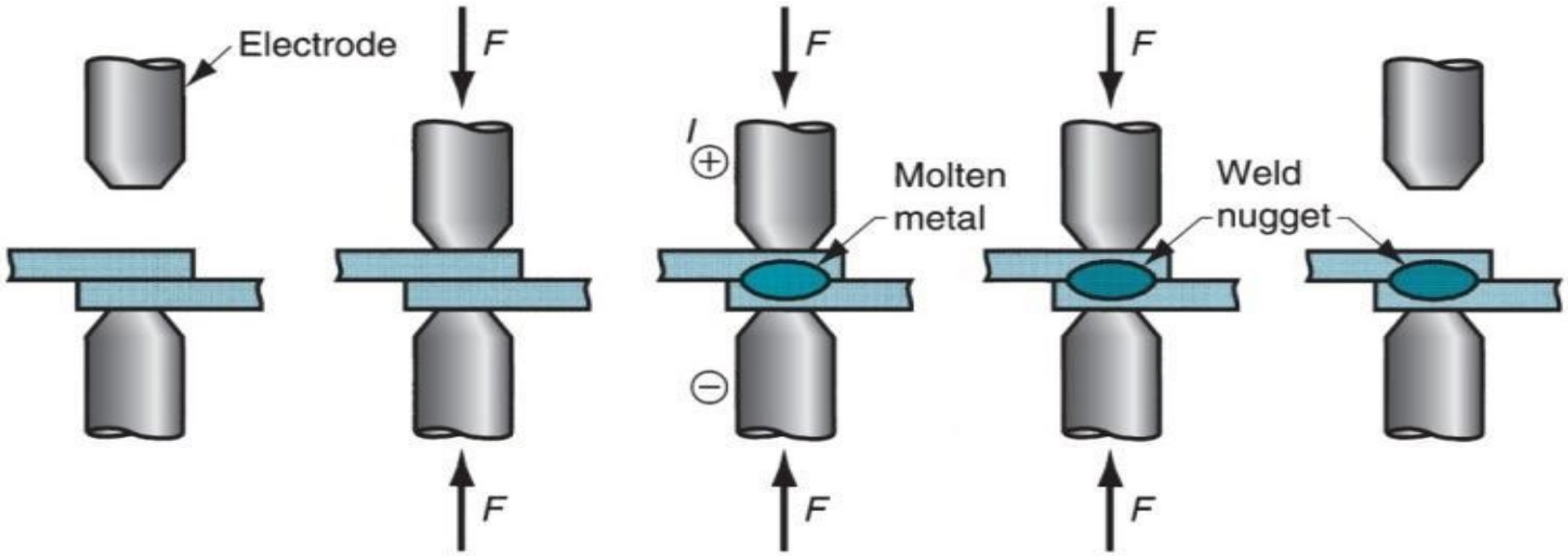
- Used to weld **thin sections of stainless steel and non-ferrous** metals such as aluminum, magnesium, and copper alloys.
- **Aerospace industry** is one of the primary users of gas tungsten arc welding
- It is also frequently employed to weld small-diameter, thin-wall tubing such as those used in the **bicycle industry**.



Resistance **S**pot **W**elding (RSW)

➢ Introduction

- Resistance spot welding (RSW), is a process in which contacting metal surface points are joined by the heat obtained from resistance to electric current.
- Work-pieces are held together under pressure exerted by electrodes
- It is a from of a solid state welding
- The whole process can be fully automated
- No fillers and flux or shielding gases needed



➢ Main Applications

- Spot welding is typically used when welding particular types of sheet metal and wire mesh.
- The most common application of spot welding is in the automobile manufacturing industry.
- Spot welding is also used in the orthodontist's clinic.
- Spot welding can be used for attaching braces, pads or clips with cases, bases and covers which are mainly product of sheet metal forming.

➢ Types of resistance welding

- Resistance butt welding of tubes fig. 2.24.
- Seam welding fig. 2.25
- Projection welding fig. 2.26

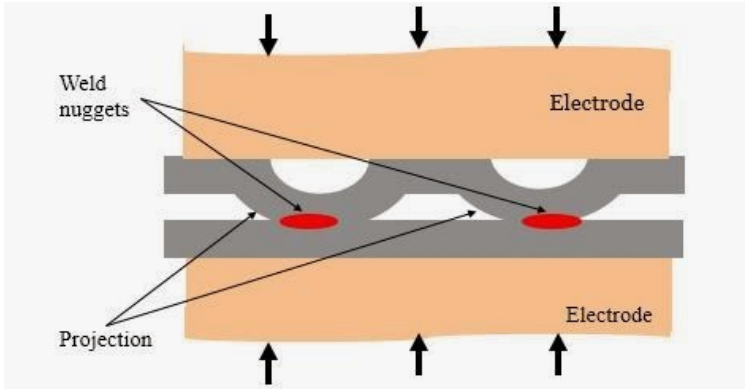


fig. 2.26 Projection Welding

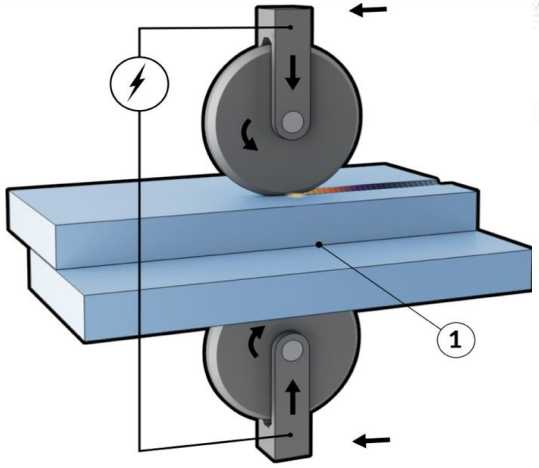


fig. 2.25 Seam welding

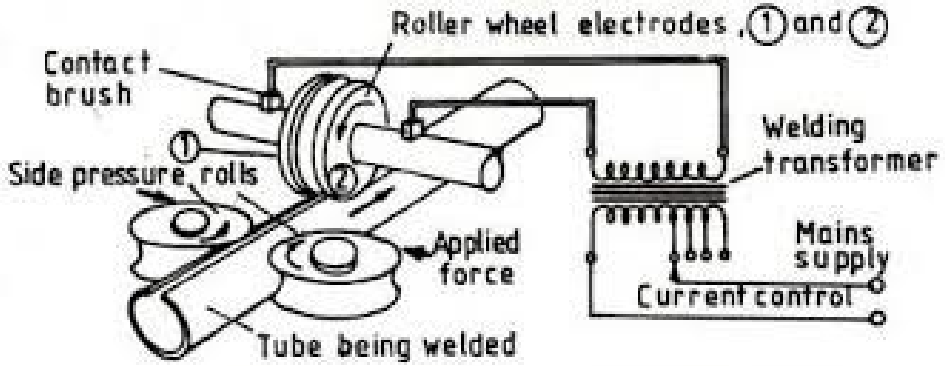
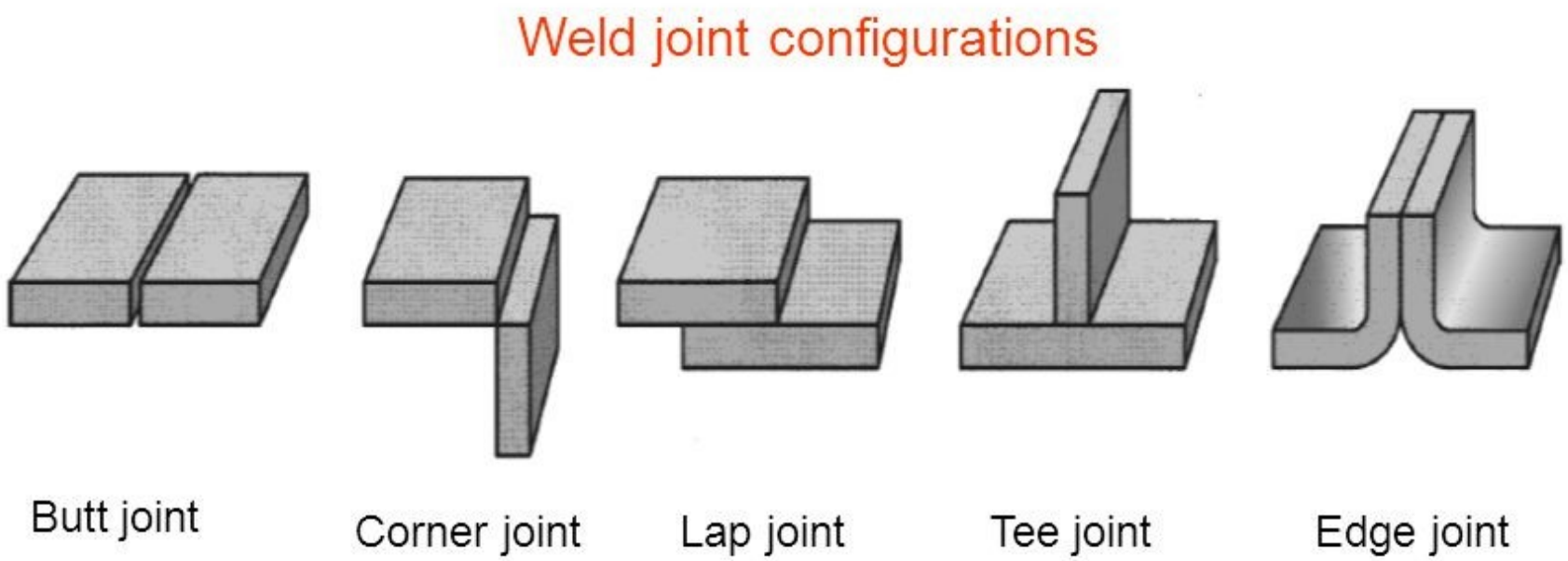


Fig. 2.24 Electric resistance butt welding process of tube making.

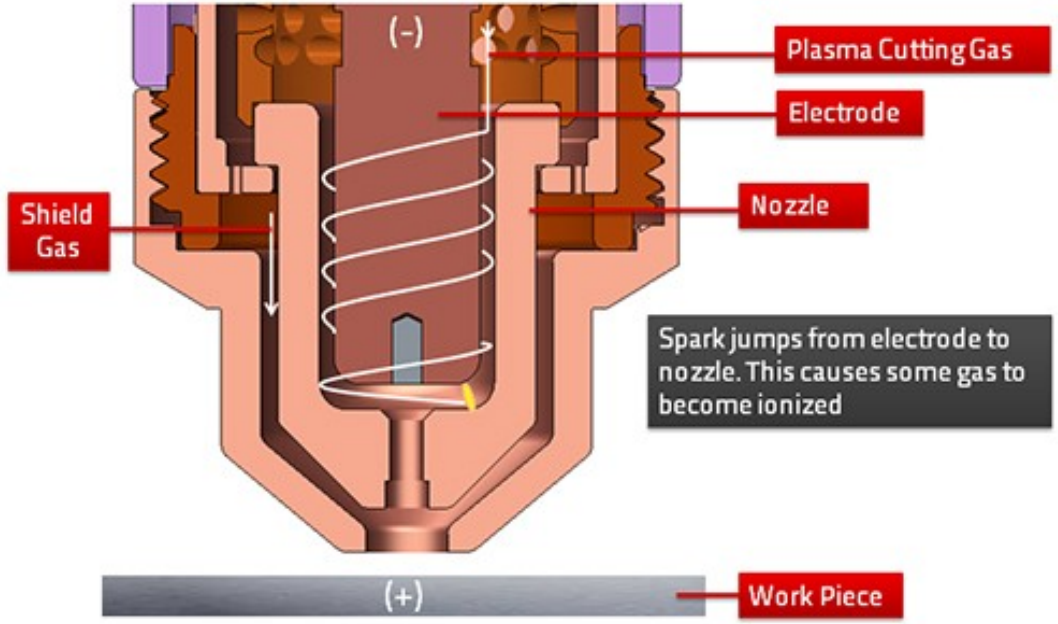
Basic Joints Design



Plasma Cutting

➢ Introduction

- Plasma cutting is a process that cuts through electrically conductive materials by means of an accelerated jet of hot plasma
- Typical materials cut with a plasma torch include steel, Stainless steel, aluminum, brass and copper, although other conductive metals may be cut as well

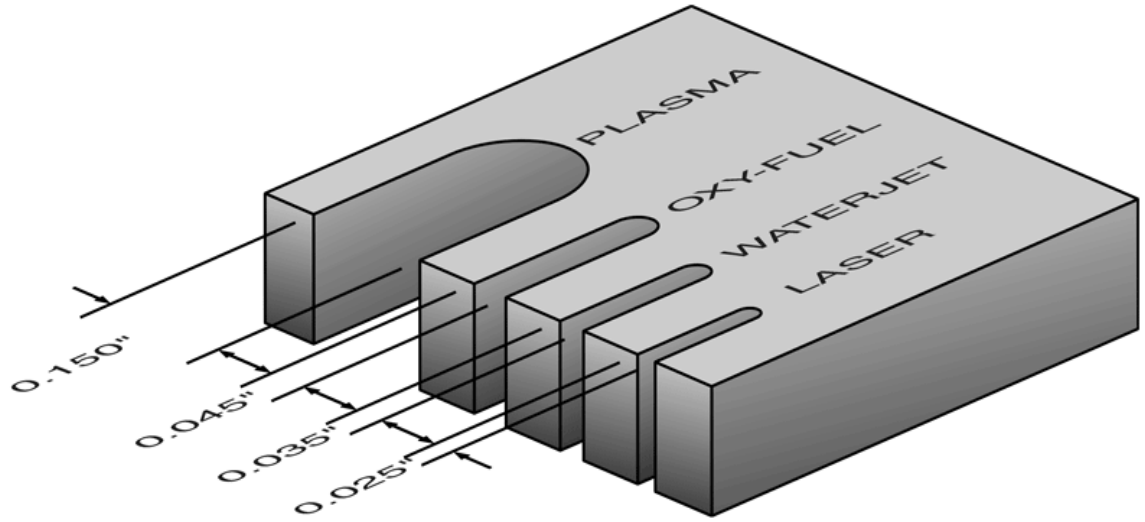


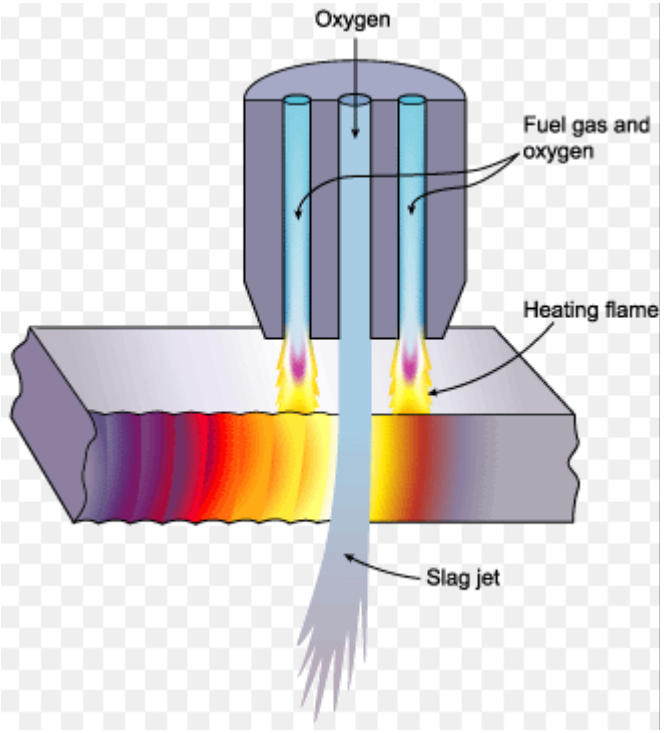
➢ Gases used in Plasma Cutting

- Argon
- Helium
- Nitrogen
- mixtures of these gases are used for both the inner and outer shields.

➢ Another Thermal Processes used for Cutting

- Oxygen fuel gas cutting: Suitable for cutting thick steels, can cut only low to medium carbon steels.





Thank You ㅆ