Manufacturing Processes– UTA026

Welding – GMAW or MIG Process

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Welding Processes

MIG or GMAW

Metal Inert Gas Welding (MIG, GMAW)

- **Metal Inert Gas Welding** (Gas Metal Arc Welding) is a arc welding process, in which the weld is shielded by an external gas (Argon, helium, CO2, argon + Oxygen or other gas mixtures).
- Consumable electrode wire, having chemical composition similar to that of the parent material, is continuously fed from a spool to the arc zone.

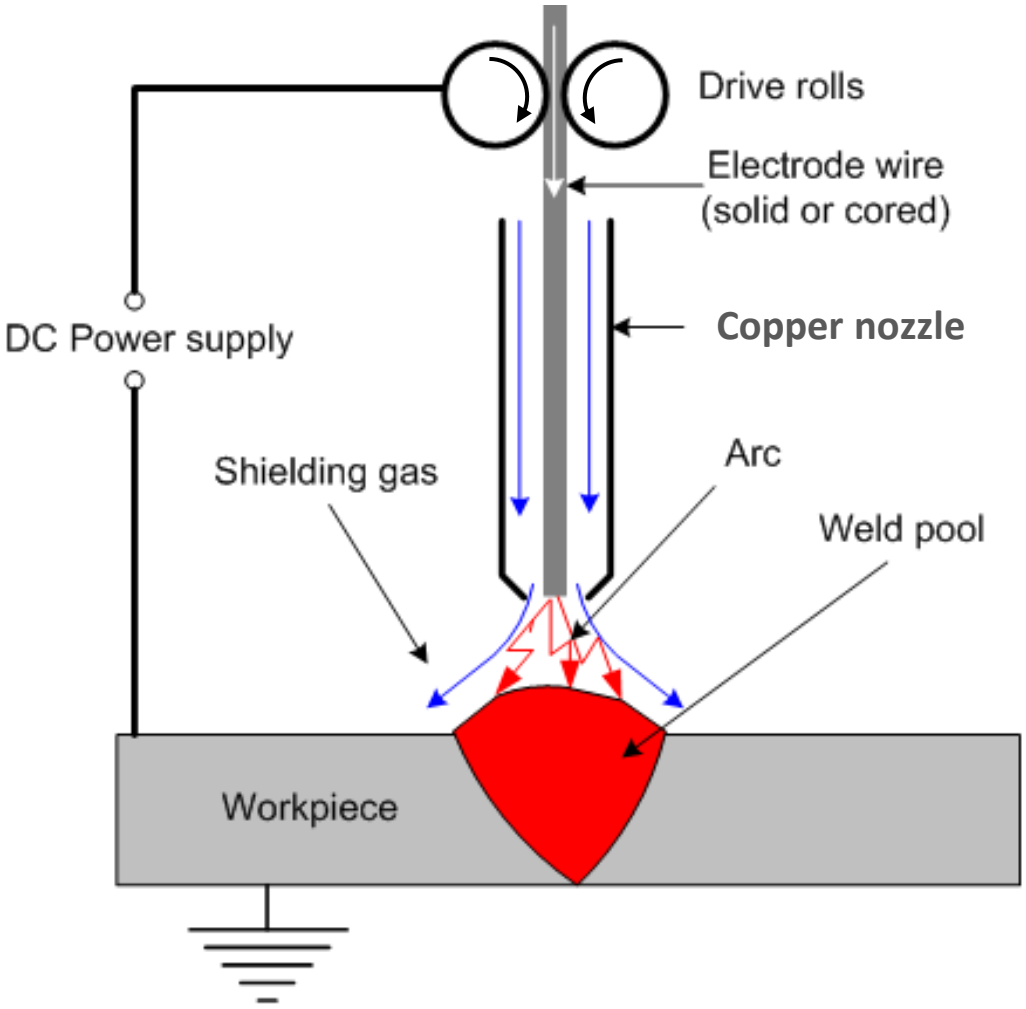
Metal Inert Gas Welding (MIG, GMAW)

- The arc heats and melts both the work pieces edges and the electrode wire. The fused electrode material is supplied to the surfaces of the work pieces, fills the weld pool and forms joint.
- Due to automatic feeding of the filling wire (electrode) the process is referred to as a semi-automatic. The operator controls only the torch positioning and speed.

Metal Inert Gas Welding (MIG, GMAW)

- Gas metal arc welding(GMAW) is an AW process in which the electrode is a consumable bare metal wire, and shielding is accomplished by flooding the arc with a gas.
- The bare wire is fed continuously and automatically from a spool through the welding gun, as illustrated in Figure.

Metal Inert Gas Welding (MIG, GMAW)



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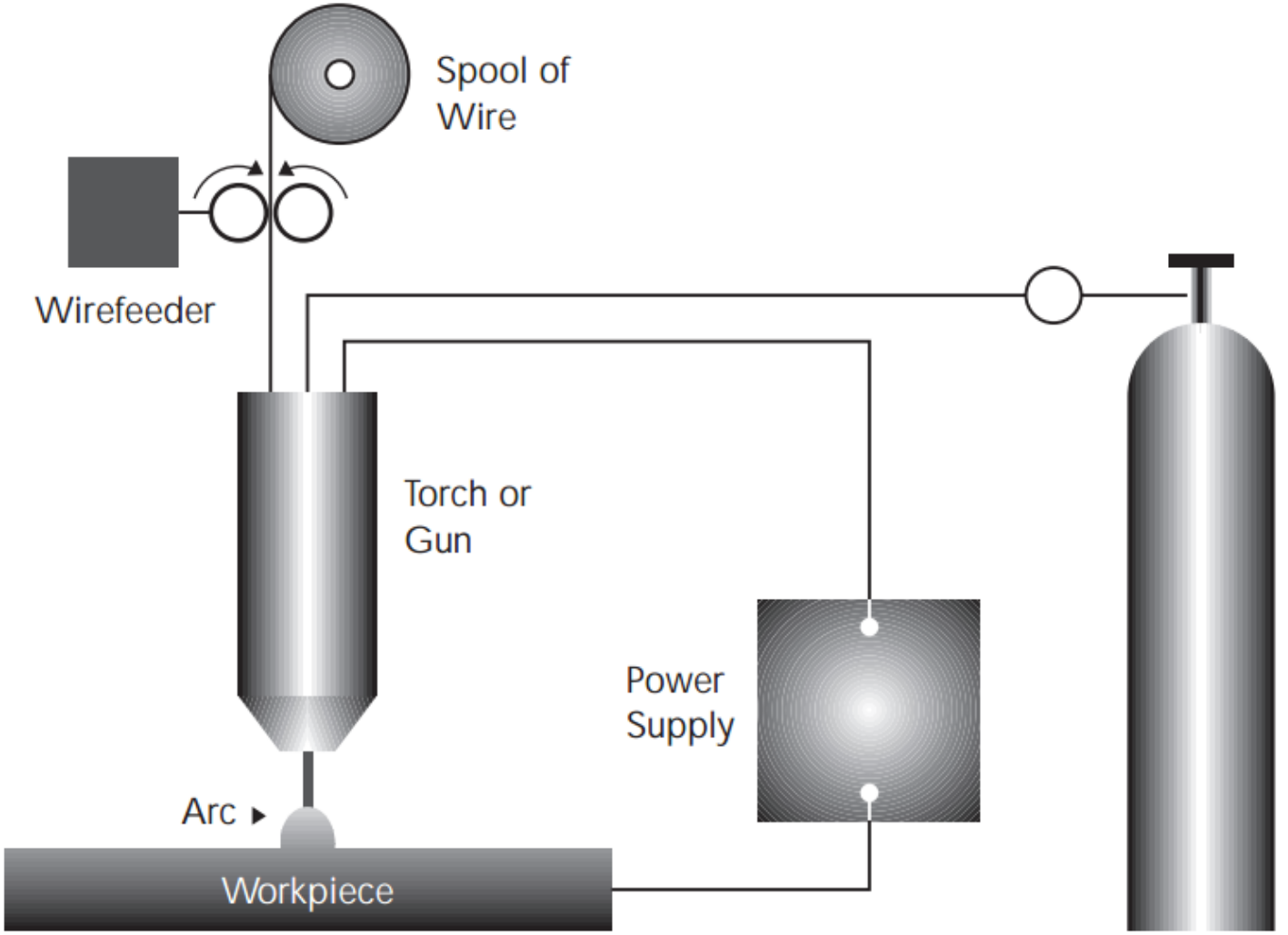

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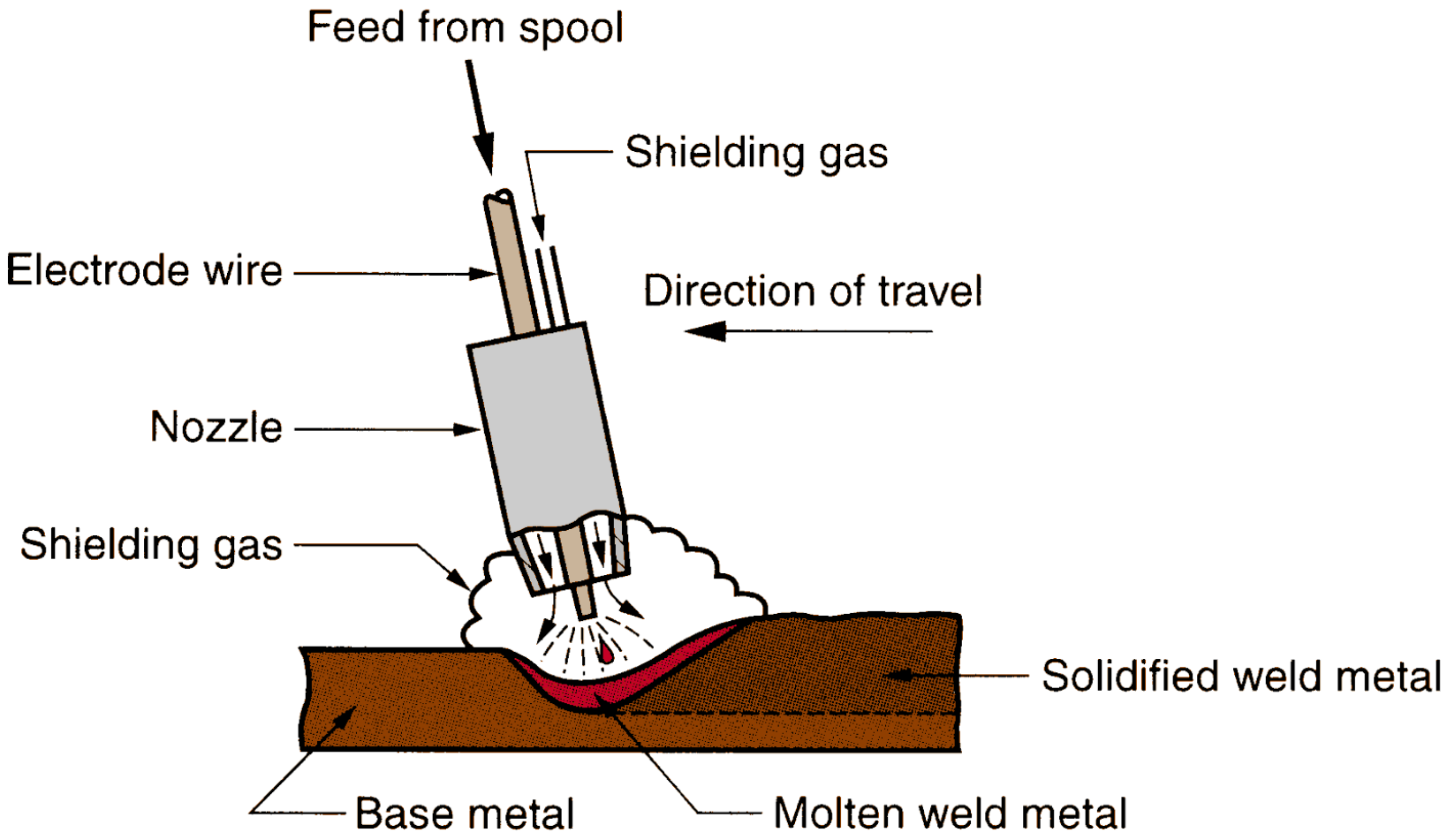


Metal Inert Gas Welding (MIG, GMAW)

- Wire diameters ranging from 0.8 to 6.5 mm (1/32–1/4 in) are used in GMAW, the size depending on the thickness of the parts being joined and the desired deposition rate.
- Gases used for shielding include inert gases such as argon and helium, and active gases such as carbon dioxide.
- Selection of gases (and mixtures of gases) depends on the metal being welded, as well as other factors.

Metal Inert Gas Welding (MIG, GMAW)

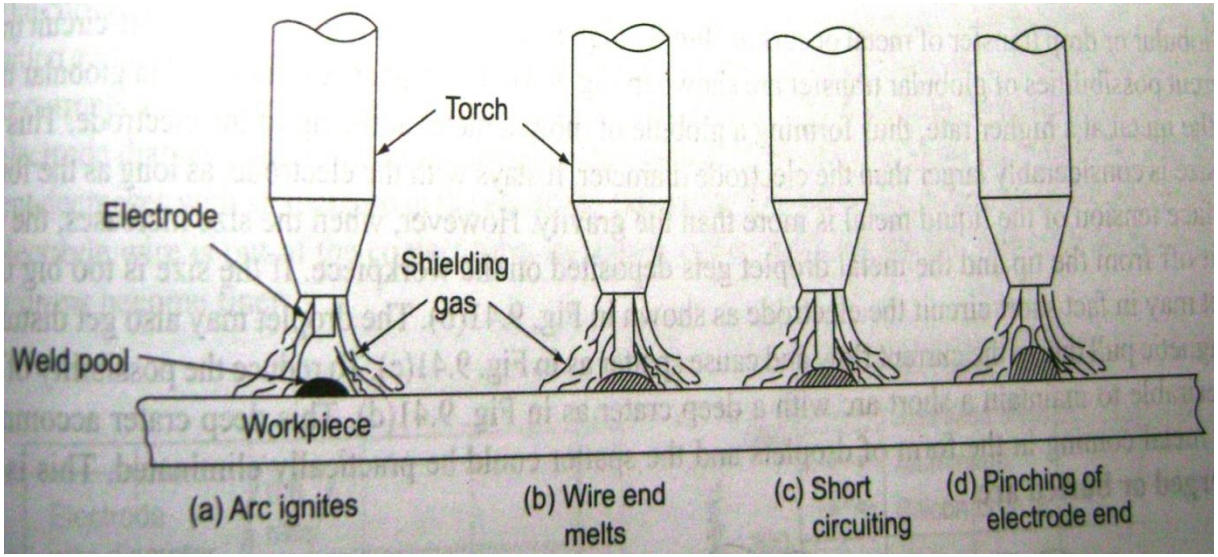
- Inert gases are used for welding aluminum alloys and stainless steels, while CO2 is commonly used for welding low and medium carbon steels.
- As there is no electrode flux used therefore there is no slag covering on the weld bead and thus no need for manual grinding and cleaning of slag.
- The GMAW process is therefore ideal for making multiple welding passes on the same joint.

GMAW – Metal Transfer modes

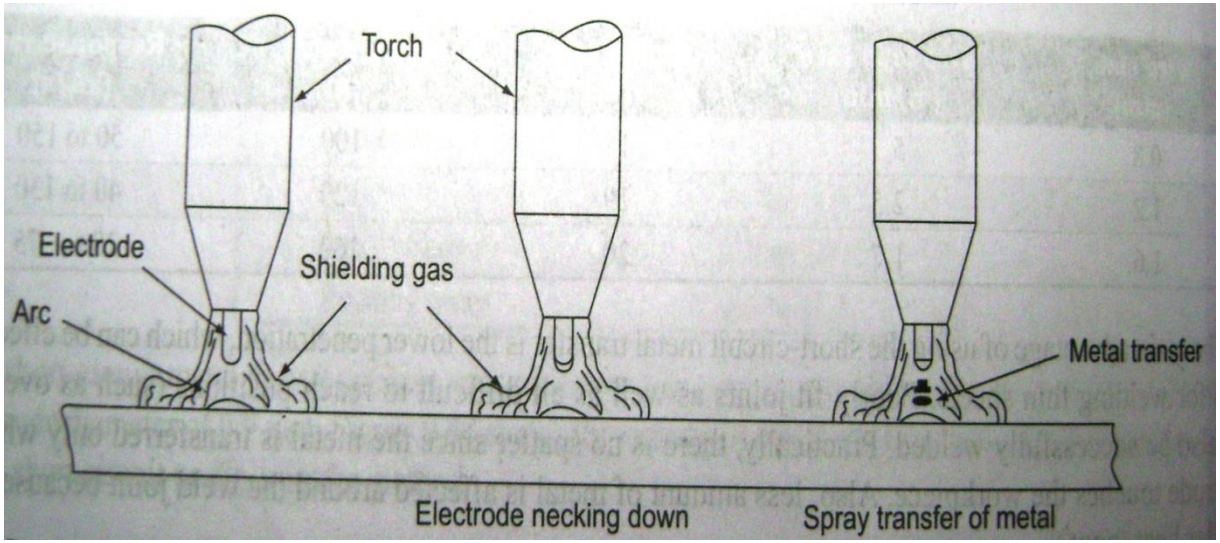
In the GMAW process, the filler metal is transferred from the electrode to the joint. Depending upon the current, voltage and the wire feed rate used for given electrode, the metal transfer is done in different ways. They are

- **Short circuit** (low voltage – lowest amperage, incomplete fusion could cause)
- **Dip transfer** (Like short-circuiting - low voltage – lowest amperage with high wire feed rate)
- **Globular transfer** (high voltage-high amperage, high deposition with high spattering)
- **Spray transfer** (axial & pulsed) – very high voltage and amperage (highest), good deposition, high heat produced, pulsed spray with high to low amperage cycles due to pulsing cycles)

GMAW – Metal Transfer modes



SHORT CIRCUIT & Dip METAL TRANSFER



SPRAY TRANSFER

Metal Inert Gas Welding (MIG, GMAW)

ADVANTAGES

- Continuous weld may be produced (no interruptions)
- High level of operators skill is not required
- Slag removal is not required (no slag)

Metal Inert Gas Welding (MIG, GMAW)

DISADVANTAGES

- Expensive and non-portable equipment is required
- Outdoor application are limited because of effect of wind, dispersing the shielding gas

References

- M. P. Groover, Fundamentals Of Modern Manufacturing: Materials, Processes, and Systems, Wiley (2010), 4th edition.
- Degarmo, E. P., Kohser, Ronald A. and Black, J. T., Materials and Processes in Manufacturing, Prentice Hall of India (2008) 8th ed.
- Kalpakjian, S. and Schmid, S. R., Manufacturing Processes for Engineering Materials, Dorling Kingsley (2006) 4th ed.