

Selection of Shielding Gas for Arc Welding

Shielding gas	Applicable welding Process					Comments
	Carbon and low alloy steels	Stainless Steel	Aluminum and its Alloy	Titanium and its alloy	Copper and its alloys	
Argon	GTAW(DC), GMAW,* plasma	GTAW(DC), GMAW, plasma	GTAW(AC), GMAW,	GTAW(DC), GMAW, plasma	GTAW(DC), plasma	Most widely used shielding gas. Easy arc are starting, smooth quiet arc, good weld bead appearance and quality.
Helium	GTAW (DC), plasma	GTAW (DC)	GTAW (DC)	GTAW (DC)	GTAW(DC), plasma	Deeper penetration, faster welding speeds but harder arc starting and more expensive than argon. Mostly used for automatic welding.
Argon/helium	GTAW (DC), plasma	GTAW (DC), plasma	GTAW (DC), GMAW	Plasma	GTAW(DC), GMAW, plasma	Compromise between relative advantages and disadvantages of argon and helium.
Argon/hydrogen	—	GTAW (DC), plasma	—	—	—	High heat input and penetration Many automatic welding, can cause porosity if misused.
Argon/oxygen	—	GMAW	—	—	—	More stable arc and better weld bead appearance than with argon.
Carbon dioxide	GMAW	—	—	—	—	Suitable for welding thin sections by dip transfer. Procedures good penetration but a violent arc. Creates spatter when using high currents for thick sections. Cheapest shielding gas.
Helium/argon/carbon dioxide	—	GMAW	—	—	—	Allows welding of thin sections by dip transfer.

Key: GTAW = Gas Tungsten Arc Welding; GMAW = Gas Metal Arc Welding; AC = Alternating Current; DC = Direct Current

*Ar/CO₂ mixture is another alternative to CO₂ if good weld bead appearance or mechanical properties are required.