Description

Image

Image caption

(1) Hotwire TIG © TWI Ltd at flickr (2) TIG welding © TWI Ltd at

The process

TUNGSTEN-INERT GAS (TIG) welding is a heavy-duty welding process (others are MMA and MIG) is the cleanest and most precise, but also the most expensive. In one regard it is very like MIG welding: an arc is struck between a non-consumable tungsten electrode and the work piece, shielded by inert gas (argon, helium, carbon dioxide) to protect the molten metal from contamination. But, in this case, the tungsten electrode is not consumed because of its extremely high melting temperature. Filler material is supplied separately as wire or rod. TIG welding works well with thin sheet and can be used manually, but is easily automated. Both penetration and deposition rates are much less than those of MIG welding, but precise control of the weld is easier.

Process schematic

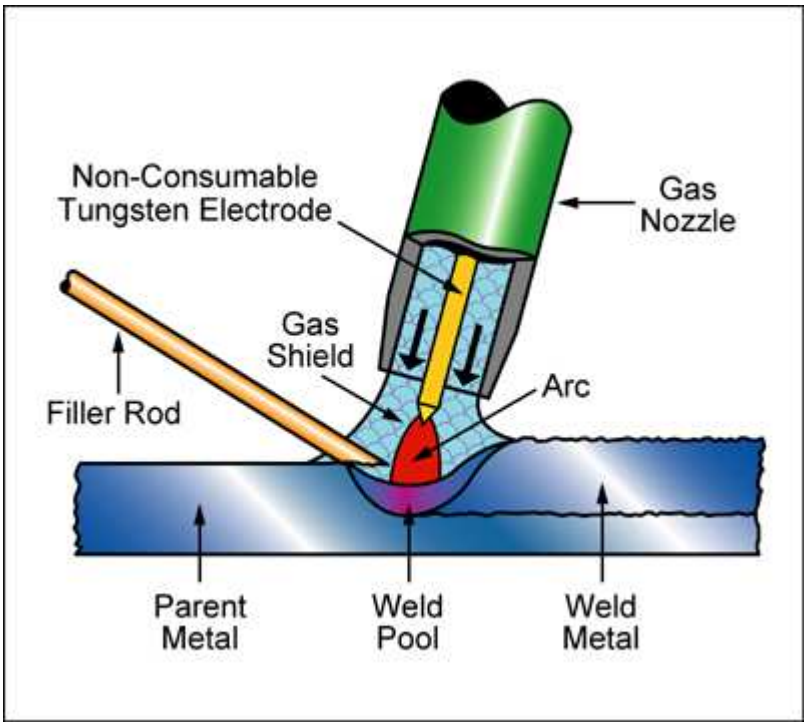

Figure caption

Tungsten - inert gas welding

Material compatibility

Metals - ferrous	✓
Metals - non-ferrous	✓

Function compatibility

Electrically conductive	✓
Thermally conductive	✓
Watertight/airtight	✓
Demountable	✗

Joint geometry compatibility

Lap	✓
Butt	✓
Sleeve	✓
Scarf	✓
Tee	✓

Load compatibility

Tension	✓
Compression	✓
Shear	✓
Bending	✓
Torsion	✓
Peeling	✓

Economic compatibility

Relative tooling cost	low
Relative equipment cost	medium
Labor intensity	low

Physical and quality attributes

Mass range	870	-	2.25e3	kg
Range of section thickness	0.7	-	8	mm
Unequal thicknesses	✓			
Processing temperature	597	-	1.98e3	℃

Process characteristics

Discrete	✓
Continuous	✓

Supporting information

No warranty is given for the accuracy of this data

Design guidelines

Because the heating is de-coupled from the filler supply, greater control of weld conditions is possible. Thus, TIG welding is used for thin plate and for precision assemblies, made of almost any metal. Clean surfaces and well-prepared joints are important. It's principally used for thin sections and precisely made joints.

Technical notes

TIG welding produces very high quality welds on metals such as aluminum, magnesium, titanium, stainless steel, and nickel; cast iron and mild steel are also easily welded. The arc is started by a high frequency AC discharge to avoid contaminating the tungsten electrode; it is subsequently maintained by a DC current or a square wave AC current, which gives greater control of penetration.

Typical uses

TIG welding is one of the most commonly used processes for dedicated automatic welding in the automobile, aerospace, nuclear, power generation, process plant, electrical and domestic equipment markets.

The economics

The equipment is more expensive and less portable than torch, and a higher skill level is required of the operator. But the greater precision, the wide choice of metals that can be welded and the quality of the weld frequently justify the expense.

The environment

TIG welding requires the same precautions as any other arc welding process: ventilation to prevent inhalation of fumes from the weld pool, and visors or colored goggles to protect the operator from radiation.

Links

MaterialUniverse

Reference

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