MICRO STRUCTURE ANALYSIS OF TIG WELDED HSS 301 ALLOY

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Abstract - This Research paper in work deals with micro structure analysis of TIG welding HSS 301 plates of dimension 200 ×77 × 8 mm were taken, as high stainless steel plate. The input parameters are root gap, current, in research is in new technology used Advance in used Aerospace Industries, defiance Research development Organization, Electrical Industries, welding Constructions, Underground Gas pipes welding Brig Constructions, towers etc Electrode diameter and gas flow rate. The main effects plots were plotted using Minitab software .the analysis is done with analysis software.

Key words: TIG welding, HSS, Hardness, root gap, S/N Ratio, Advance Applications TIG Welding

INTRODUCTION Gas Tungsten Advance welding is an electric arc welding process, in which the fusion energy is produced by an electric arc burning between the work piece and the tungsten electrode. During the welding process the electrode, the arc and the weld pool are protected against the damaging effects of the atmospheric air by an inert shielding gas. By means of a gas nozzle the shielding gas is lead to the welding zone where it replaces the atmospheric air. TIG welding differs from the other arc welding processes by the fact that the electrode is not consumed like the electrodes in other processes such as MIG/MAG and MM. High Stainless steel is widely used in sheet metal fabrication, especially in automotive, chemical and rail coach manufacturing, mainly due to its excellent corrosion resistance and better strength to weight ratio. Stainless steel is a generic name covering a group of metallic alloys with chromium content in excess of 10.5 percent and a maximum carbon content of 1.2 percent (according to European Standard EN 10088) and often includes other elements, such as nickel and molybdenum. Due to formation of a passive layer, this is 1 to 2 nanometers thick; this metal exhibits excellent corrosion resistance. The passive layer is self healing, and therefore chemical or mechanical damages to it re-passivity in oxidizing environments. Stainless steel has been widely used for rail vehicle body shell design for many years owing to its corrosion resistance, low life-cycle cost, and high strength-to weight ratio and fire resistance.

1.1Working Principle of TIG Welding Operation Tungsten Advance welding (TIG) is an arc welding process, as shown in Fig. Wherein coalescence is produced by heating the work piece with an electrical arc struck between a tungsten electrode and the job. The electrical discharge generates a plasma arc between the electrode tip and the work piece to be welded. It is an arc welding process wherein coalescence is produced by heating the job with an electrical arc struck between a tungsten electrode and the job.

The arc is normally initialized by a power source with a high frequency generator. This produces a small spark that provides the initial conducting path through the air for the low voltage welding current. The arc generates high-temperature of approximately 6100 C and melts the surface of base metal to form a molten pool. A welding gas (argon, helium, nitrogen etc) is used to avoid atmospheric contamination of the molten weld pool. The shielding gas displaces the air and avoids the contact of oxygen and the nitrogen with the molten metal or hot tungsten electrode. As the molten metal cools, coalescence occurs and the parts are joined. The resulting weld is smooth and requires minimum finish.

2. HIGH - SPEED STEEL (HSS or HS) is a subset of tool steels, commonly used as cutting tool material. It is often used in power-saw blades and drill bits. It is superior to the older high-carbon steel tools used extensively through the 1939s in that it can withstand higher temperatures without losing its temper (hardness).

2.1 COMPOSITION OF HIGH SPEED STEEL

The chemical Composition of the High Speed Steel Carbon 0.7655% , Tungsten 18.0660% , Iron 74.600% , Chromium 4.100% , Vanadium 1.000% , Molybdenum 2.0649% , Silicon 0.5670%, Cobalt 0.405%. Its combination of Advance High speed steel.

2.2 COMPOSITIN OF TIG ARC WELDING

The Chemical Composition of Tungsten Inert Gas Arc Welding

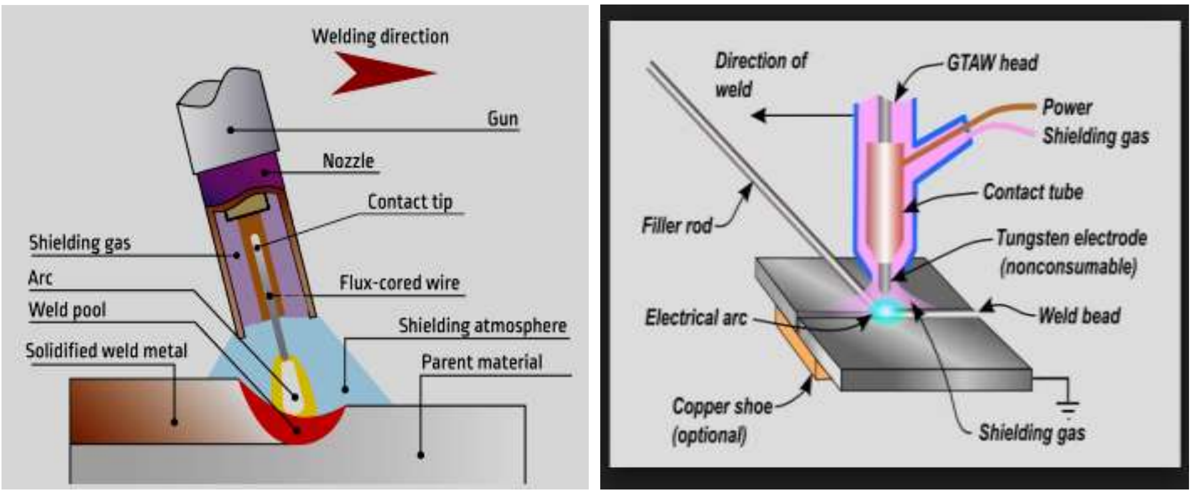

FIGURE 2.2.1 Working Principale of Tungesten Inert Gas Welding High Speed Steel

3. ADVANCE APPLICATIONS OF HIGH SPEET STEEL

Advance Applications of High Speed Steel Saficient Same of Areas Industrial Manufacturing Cutting Tools materials

3.1 Tools of Lathe CNC, DNC, NC Machines

FIGURE 3.1HSS Tools 6mm Square Shanks of Lathe Machines

3.2 Drilling Macine Tools

Drilling Machine Tools

FIGURE 3.2.1 Drilling Machine Tools

FIGURE 3.2.2 Precision Twist Drill -1-9/119 HSS TOOL

ShaperMachine Tools, Planer Machine tools, Milling Machine Tools, and Tapping Operations

Aircraft structural parts

Trailer bodies

Architectural (roof drainage/door frames, etc

Auto body trim and wheel covers

Utensils and table wear

Conveyor parts

4. EXPERIMENTAL SET-UPS

FIGURE 4.1 EXPERIMENTAL SET-UPS

4.1 TABLE EXPERIMENTAL WORKING

EXPERIMENT	ROOT GAP (MM)	CURRENT (AM)	ELECTROD DIAMETER (MM)	GAS FLOW LITERS /MINUTES
1	1.2	110	1.8	1.9
2	1.2	150	2.6	3.9
3	1.2	176	3	5
4	2	100	2.6	5
5	2	151	3	2
6	2	171	1.6	4
7	2.5	100	3	4
8	2.5	149	1.7	5
9	2.5	169	2.5	2

5. Weld Zone Heat Affected Zone

Weld Zone and Heat Affected Zone TIG Arc Welding in Microstructure Analysis of High Speed Steel plates

Experiment 1 (Roots gaps=1.2, 1.2, 1.2 mm, currents =110, 150, 176 Amps, Electrodes diameters =1.8, 2.6, 3 mm, Gas flow rates =1.9, 3.9, 5 litres/minutes)

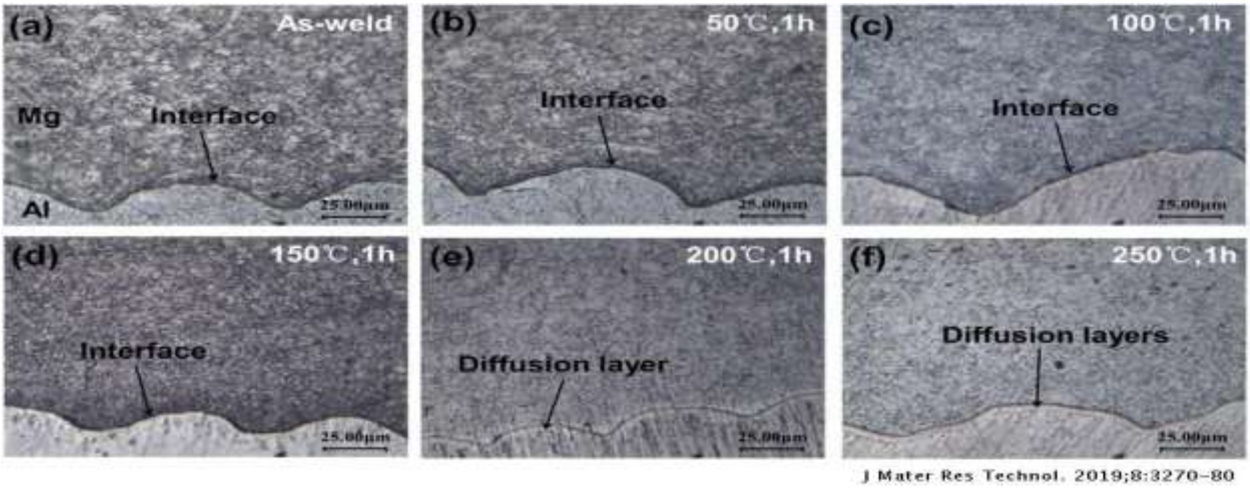

FIGURE 5.1 Microstructure Analysis of High Speed Steel plates

(FIRST STAGE)

Experiment 2 (Roots gaps=2, 2, 2 mm, currents =100, 151, 171 Amps, Electrodes diameters =2.6, 3, 1.6 mm, Gas flow rates =5, 2, 4 litres/minutes)

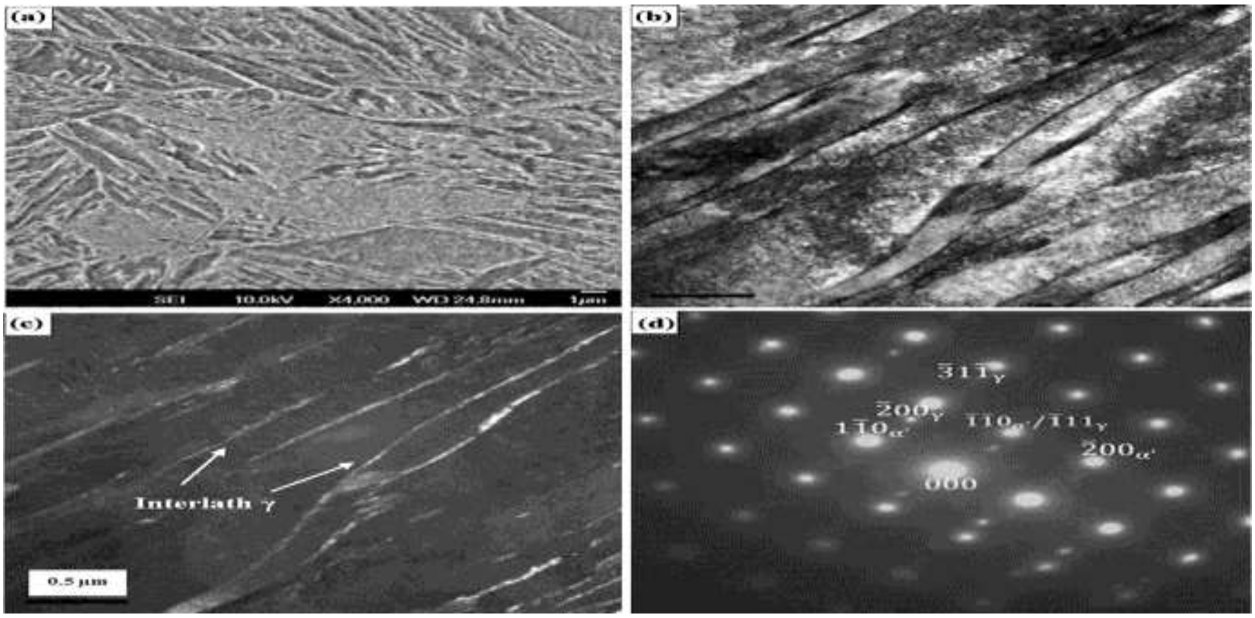

FIGURE 5.2 Microstructure Analysis of High Speed Steel plates

(SECOND STAGE)

The Microstructure Analysis of High Speed Steel plates in Tungsten Inert Gas Arc Welding

Experiment 1 (Roots gaps=2.5, 2.5, 2.5 mm, currents =100, 150, 170 Amps, Electrodes diameters =3, 1.6, 2.5 mm, Gas flow rates =4, 5, 2 litres/minutes)

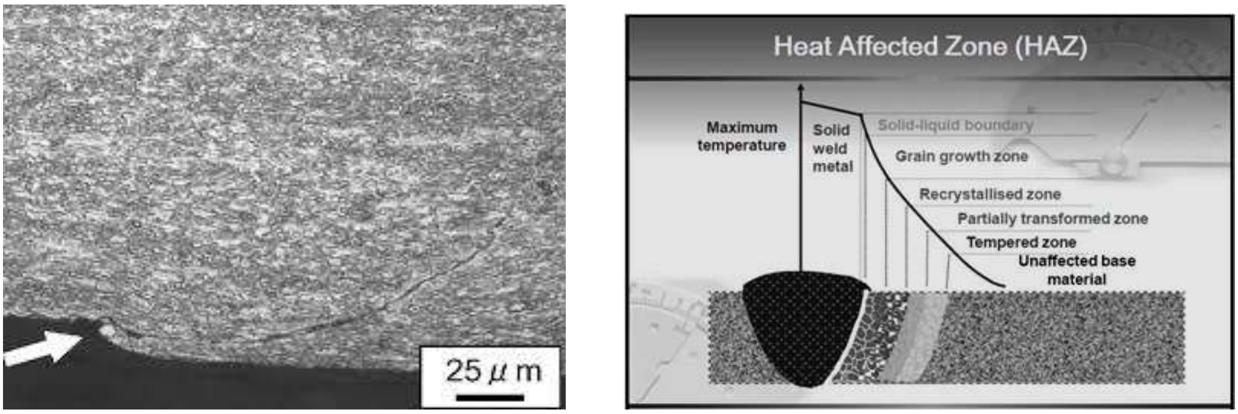

FIGURE 5.3 Microstructure Analysis of High Speed Steel plates

(THIRD STAGE)

6. RESULT AND DISCUSION

1. Hardness in heat affected zone was more than hardness in weld zone and base metal

2. Tungsten %was more in weld zone than Haz in most cases Tungsten %was more in HAZ zone Tungsten% was higher in weld zone because austenite requires high temperature for its formation approx (600-675°C

3. From the graphs it was observed that, when root gap increases, angular distortion increases when electrode diameter was increased hardness first increased then decreased

4. In most cases, Base metal hardness was more than weld metal hardness

5. Tungsten% was higher in heat affected zone because the ferrite contains only a small amount of carbon which means untransformed austenite will become more enriched with carbon as temperature decreases and more Tungsten is formed

6. For minimum value of root gap, current, electrode diameter angular distortion was minimum, when current and electrode diameter are increased, hardness first increases and then it stabilized.

7. CONCLUSION

Heat affected zone region had higher hardness compared to weld zone and base metal the Tungsten increases in high speed steel and of chromium both are materials percentage increases high speed steels strength and hardness properties is also increases and corrosion Resistant and high speed steel composite life is Increses.

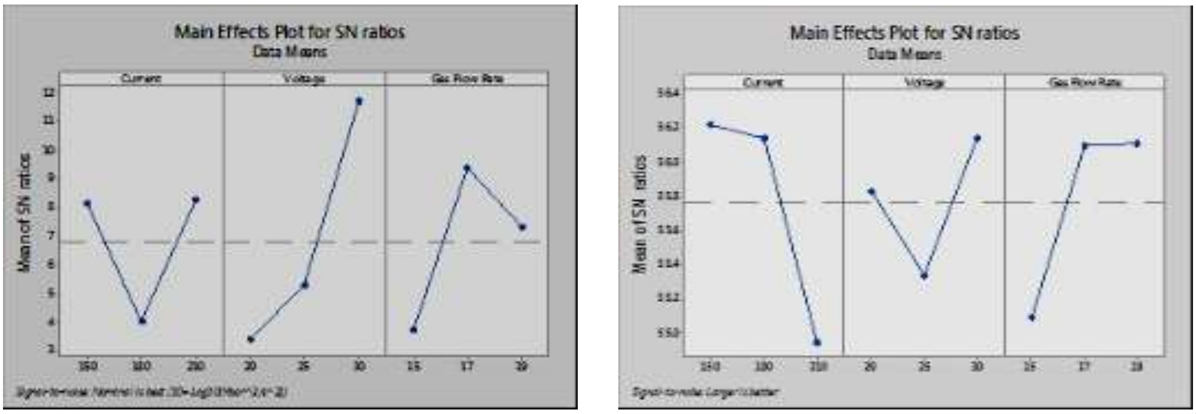

Figure 6.1: hardness

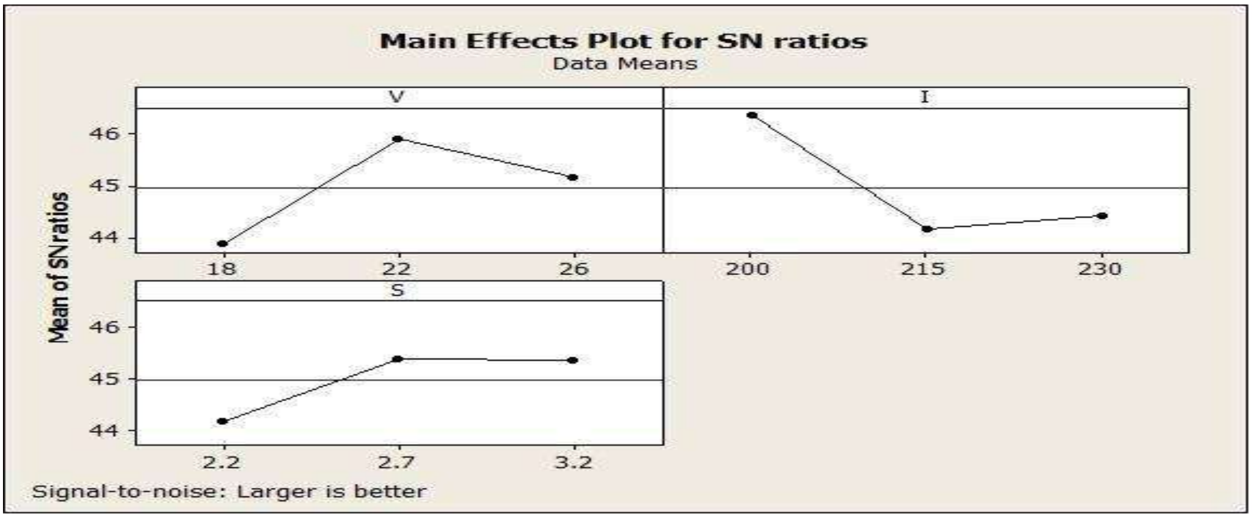

Figure 6.2: hardness weld zone

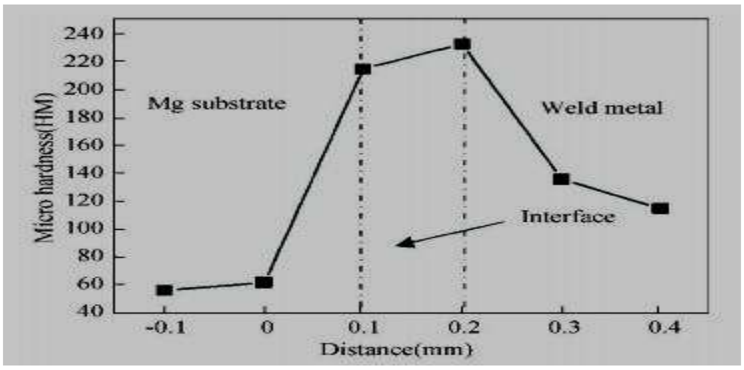

Figure 6.3 S/N Ratio for hardness HAZ

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