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Experimental investigation of weld characteristics of single pass semi automatic TIG welding with dissimilar stainless steels

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Abstract:*Project application is involved with aero space ,nuclear and underwater industries where complex geometry and fully automated systems.Main objective of the experimental of factors affecting to mechanical property of austenitic stainless steel with semi automatic Gas Tungsten Arc welding (GTAW)at different welding parameters.SS202 &SS410 stainless steel of 3mm thick is taken for experiments.Research will be applied Taguchi method on an austenitic stainless steel specimen of dimensions 100x100x4mm,which have various arc current, arc voltage , welding torch angle and ultimate tensile strength.*

Keywords:*Semi automatic GTAW,Stainless material,Taguchi method,Ultimate tensile strength.*

1.INTRODUCTION

The different grade material and the parameters were selected and studied.Literature survey is taken and getting some idea from the experts.Materials were purchased and properties are studied.Groove preparation is studied and the ASTM standards are studied.Semi automatic TIG welding process is studied.

2.LITERATURE SURVEY Ramachandran et.al.(Aug.2015), Above researcher conduct experiments on analysis and experimental investigations of weld characteristics for a TIG welding with SS316L. **Akash.B.Patel et.al (Jan.2014),** Above researcher conduct experiments on the effect of activating flux in Tig welding . **V.Anand Rao et. al(2014),** Above researcher conduct experiments on experimentalinvestigation for welding aspects of stainless steel 310 for the process of TIG welding .**D.Devakumar et.al (Jan.2014),** Above researcher conduct experiments on research on gas tungsten arc welding of stainless steel –an overview.**Research Gap:** Above researcher is not done with the different grade materials(SS202&SS410)and the parameters(AMPHERE,VOLTAGE,WELDING SPEED)selection and not researched over Taguchi design is for process parameters selection and also groove prepared as per the ASTM standards.

3.EXPERIMENTAL DETAILS

3.1 TIG WELDING MACHINE SPECIFICATIONS:

Fig-1: TIG welding machine

Table-1: TIG welding machine specifications

Uni-Tig 250 JN AC/DC	
Voltage	415/440 3 phase 50/60htz option
Welding current TIG (AC)	27-270A
Duty cycle(AC)	60%@250A 100%@190A
Duty cycle (DC)	60%@240A 100%@190A
Ampere settings	24
Remote facility & H/F	Yes
Over load protection	standard
Protection	1p2
Dimensions	H800XL940XW350
Weight	115Kg
Standard Torch & Regulator Set Up	
Torch	WP26-4
Regulator	UNI-FLAME

3.2 MATERIAL REQUIREMENTS:

In this project we are taken stainless steel 202 & 410 fabrication of Tungsten inert gas welding.Two metal plates are taken with 100mmx100mmx3mm size and the two plates are clamped rigidly by clamps and bolts in the Vice

Fig-2: Before welding(SS202 plates)

Fig-3: Before welding(SS410 plates)

Table-2: Material specifications

Material	Austenitic stainless steel(202&410)
Thickness	3mm
Length	100mm
Number of pieces	18

Table-3: Mechanical properties of SS202 material

PROPERTIES	
Density(x1000 kg/m^3)	7.8
Poisson's Ratio	0.27-0.30

Elastic Modulus(Gpa)	190-210
Tensile strength(Mpa)	515
Yield strength (Mpa)	275
Elongation(%)	40

Table-4: Mechanical properties of SS410 material

PROPERTIES	
Density(x1000 kg/m^3)	7.7
Poisson's Ratio	0.27-0.30
Elastic Modulus(Gpa)	160-200
Tensile strength(Mpa)	517
Yield strength (Mpa)	265
Elongation(%)	30

Fig-4.TIG welding Process

Table-3.TIG welding Weldability parameters

Stainless steel	Austenitic
Preheat temperature	550^{0}F(260^{0}C)
Post weld heat treating	Not required
Filler wire	AWS E/ER410,410NiMo and 309L

4.METHODOLOGY

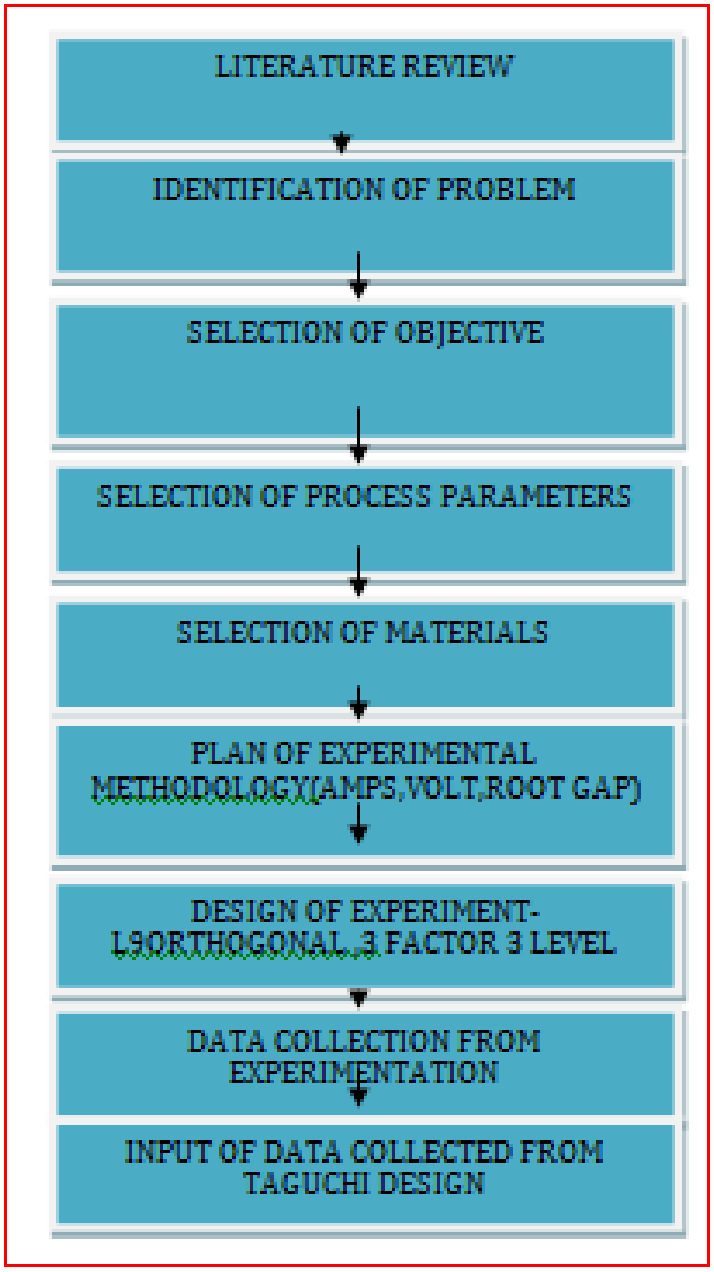

Fig-5.Experimental plan

- The dissimilarity of the metals may arise due to the difference in chemical composition .The chemical composition of the steel affects weldability and other mechanical properties and several elements are purposefully added in the production of structural steel.
- The present study would be beneficial in gaining an understanding of different heat input combinations.
- Dissimilar joints are to be conducted for better mechanical properties

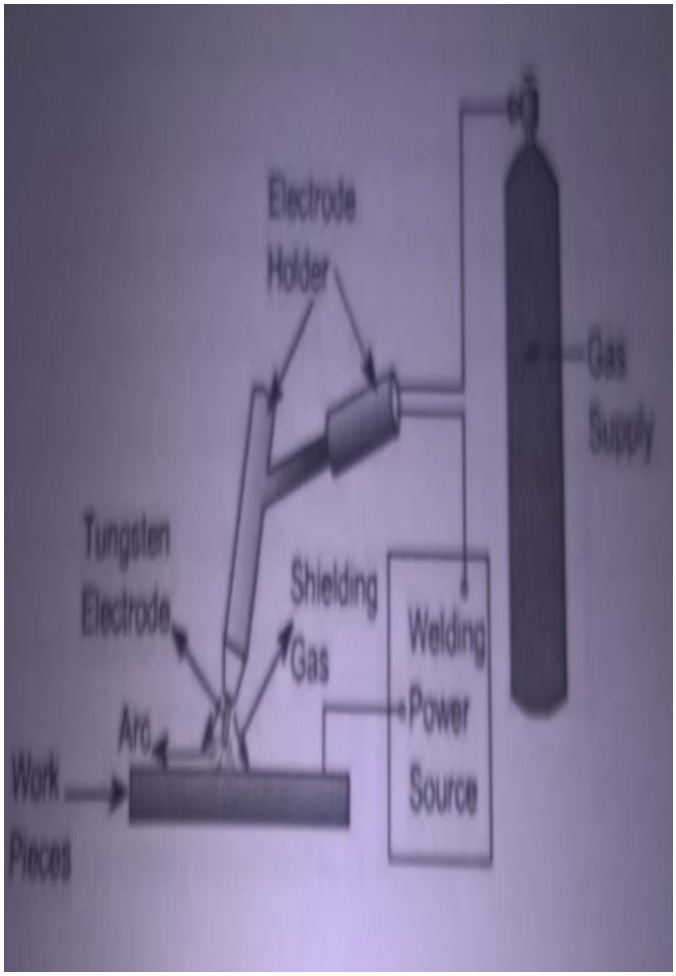

Fig-6.Schematic Diagram of TIG Welding system.

- The electric arc can produce temperatures of upto 20,000^{0}C .
- Austenitic stainless steels (202 & 410)is selected because of its low cost ,easy availability in the market.
- Semi automatic TIG welding process are chosen to carryout the experimental analysis on austenitic stainless steels.
- In this project nine samples plates (9 pieces of AISI 202 and 9 pieces AISI 410)of austenitic stainless steels are taken for experiments.

5. RESULT AND DISCUSSION

5.1 TAGUCHI DESIGN

Welding experiments are conducted on TIG welding machine with different welding parameters .The taguchi design is for getting the input welding parameters.SSplates(100x100x3mm) are involved with welding for optimizing the welding parameters with Taguchi analysis.

Table-4. Design of Experiment

Leves	Process parameters		
	AMPHERE A	VOLT V	WELDING SPEED m/sec
1	130	80	50
2	140	90	60
3	150	100	70

- Table-4 shows the Process parameters and their levels responses for all noise factors for the given factor level combination

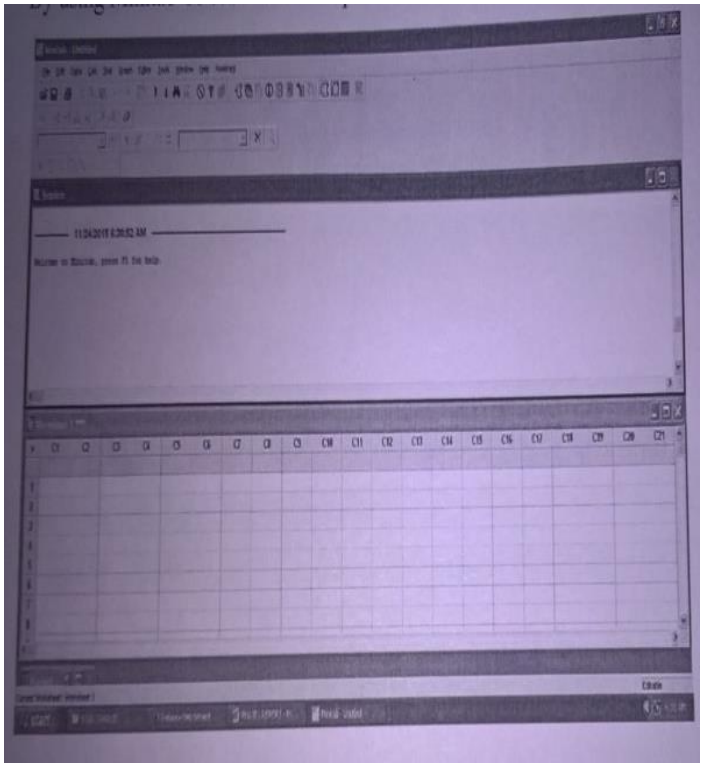

Fig-7.Experimental plan

- By using Minitab-16 software have optimized the welding parameters
- Create Taguchi Design is selected as shown in fig-8.Then a window of Taguchi design is opened .

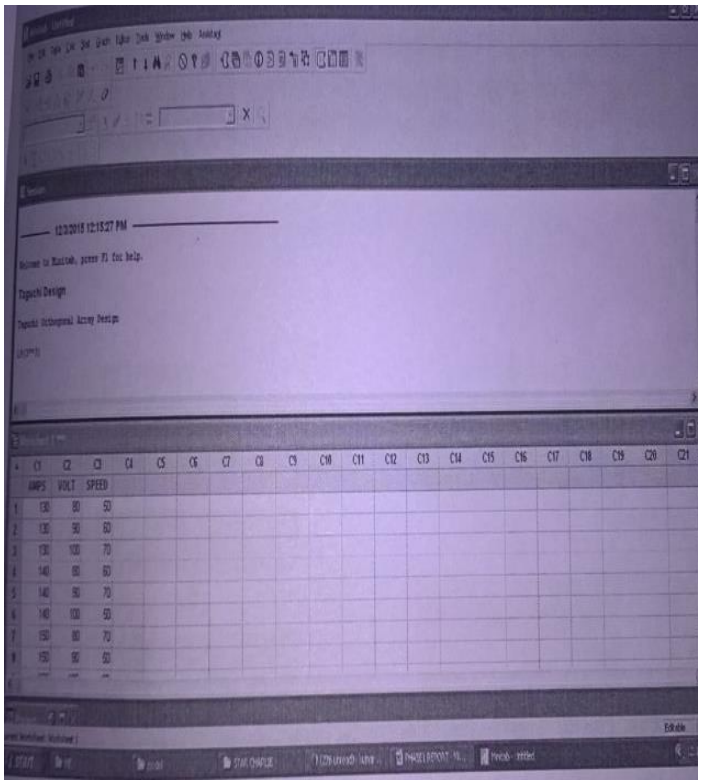

Fig-8.Experimental plan

Table-4. Process parameters

SL.NO	AMPS	VOLT	WELDING SPEED
1	130	80	50
2	130	90	60
3	130	100	70
4	140	80	60
5	140	90	70
6	140	100	50
7	150	80	70
8	150	90	50
9	150	100	60

6. CONCLUSIONS

The different grade material(SS202 & SS410) and the parameters (AMPHERE,VOLTAGE,WELDING SPEED)were selected.

Literature survey is taken and getting ideas from experts.

Materials are purchased according to the standards and groove prepared as per the ASTM standards.

The semi automatic TIG welding is carried out successfully.

Taguchi design is for process parameters selection.Post weld heat treating is not required.

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