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Psychological Factors Considered During Driving - A Review

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ABSTRACT: Investigation of MIG welding parameter optimization for surface quality is very important to improve the technology of MIG welding application. Weld bead size and shape are one of important considerations for design and manufacturing engineers. These welding parameters affecting the arc and welding bath should be estimated and their changing conditions during process must be known before in order to obtain optimum results, in this case the quality surface of overlap weld beads. The process parameters such as welding voltage, welding travel speed and wire feet rate were studied. The experiments were conducted based on a Three-factor, three-level and L_9 using Taguchi method. Taguchi methods applied to improve the quality of welding with minimum number of trails. AISI410 is used as the work piece material for carrying out the experimentation to optimize the surface quality and hardness value. The surface roughness was considered as the quality characteristic with the concept of "the smaller-the-better" and hardness "the larger-the-better. It is also predicted that Taguchi method is a good method for optimization of various input parameters as it reduces the number of experiments.

KEYWORDS: MIG Welding.

I. INTRODUCTION

Metal Inert Gas Welding (MIG):

Metal inert gas welding (MIG) is one of the welding types of gas metal arc welding (GMAW). It is a welding process in which an electric arc forms between a consumable wire electrode and the metal work piece. In this welding process, the heat be will generate through the jumping current of the gap of wire electrode and the work piece metal, causing them to melt, and join. A shielding gas feeds through the welding gun along with the wire electrode. This shielding gas shields the melting metal from contaminants in the atmosphere air.

This welding method is a semi-automatic welding process which is continuous and consumable wire electrode. In MIG welding, a constant voltage, direct current power source is most commonly used with GMAW, but constant current systems, as well as alternating current, can be used Ajit Hooda1, (2012). Investigation of MIG welding parameter optimization for surface quality is very important in improvement of the 3D MIG welding technology application. Weld bead size and shape are important considerations for design and manufacturing engineers. These welding parameters affecting the arc and welding bath should be estimated and their changing conditions during process must be known before in order to obtain the optimum results, in this case the quality surface of layered weld bead.

Problem Statement

Surface quality comes together with good mechanical properties is very important aspect in development of 3-D welding technology. This study will focus on overlap weld bead. By obtaining this good surface quality characters mean will save cost and production time of the production welding printing. The good surface quality of welding bead will lead to reduction of finishing process of the product by means the process of the milling process can be skip. The present work aim is to determine the input–output relationships of a MIG welding process. Without the optimization parameter to obtain best surface quality of weld bead, these two aspects will hard to be developed. Investigation in this project is to establish relations between the process parameters (inputs) and responses (outputs) for overlap welding bead in MIG welding process Tarng (1998). This researcher tried to obtain the optimized weld bead geometry in GTAW by using the modified Taguchi method. The modified Taguchi method allowed the simultaneous consideration of all the weld pool geometry quality characteristics for optimization. In Tarng research, overlap surface roughness were not been determine.

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Research Objectives

In this research there are three objectives and as follows:

- To investigate optimization parameter in MIG welding technology for surface quality of overlap welding beads with AISI410.
- Evaluation the surface quality of overlap weld bead using the Taguchi method.
- To propose welding process guidance for having good surface finish of weld bead.

Scope of Study

There are several scopes of study in this investigation. The scopes are:

- Study focus on welding parameter of Voltage, travel speed, and wire feed rate.
- The carbon steel metal wire feeler ER70S-6 used in this experimental work for investigates the optimization parameter of the overlap and single weld bead surface quality.
- Carbon steel plate AISI410 with the dimension of 150x40x6 mm was selected as subtract for as based metal for the samples of weld bead.
- Investigation focus on single weld bead and overlap weld bead.

II. LITERATURE REVIEW

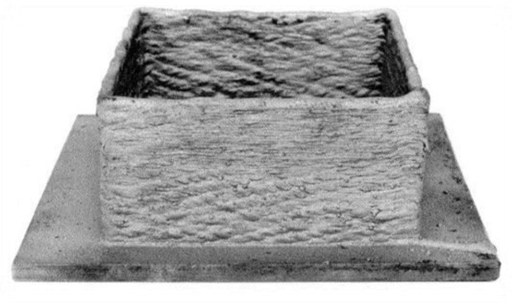
3-D Welding

Rapid Prototyping systems based on 3D welding are now being attraction to some researcher groups because it can directly build fully dense metal components with relatively lower costs. As a production technique, 3-D welding offers significant advantages over conventional processing, these include the potential for robot control of the welding torch allowing large variation in part dimensions and geometry. This technique also can be highly automated system. Parts produce by 3-D welding will provide consistent properties with rapid processing times, hence vastly reduced development times besides efficient use of materials. Through the mass transfer by direct melting the welding electrode, direct production of a metal part are the most unique amongst current Rapid Prototyping (J.P. Ganjigatti).

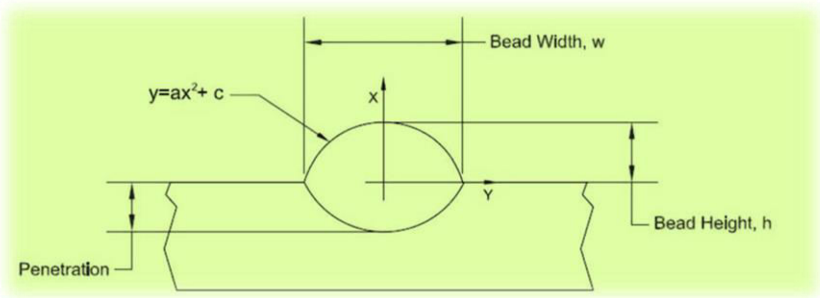
Weld Bead Geometry

Control of weld bead shape is very important as the mechanical properties of welds will affected by the weld bead shape (Connor, 1991). Because of this, it is clear that precise selection of the process parameters is necessary. Suryakumar et al (2011) have been studied the bead profile above the subtrastrate and assumed to be a symmetric parabola of the form $y = a + cx^2$

3-D Welding



Weld Bead geometry



III. METHODOLOGY

The systematically organization of this study is represented in flow chart. The investigation of welding parameter optimization for weld bead surface quality using MIG welding technology started with customize the semi-automated MIG welding machine where the welding travel assist by the travel control car. This customizes system to ensure the travel speed of welding process of weld bead experiment specimen. Semi-automatic mechanized MIG welding is extensively used for making straight welds. The work pieces are then clamped in a steady position on the working bench. The filler wire is fed from a unit that controls feed speed and that compensates automatically for variations in mains voltage and for the friction of the rollers. The parameters that are machine-controlled are the wire feed speed, the arc voltage, gas flow rate and the diameter of the wire. During the welding process, the MIG welding set will adjust the relationship between these parameters.

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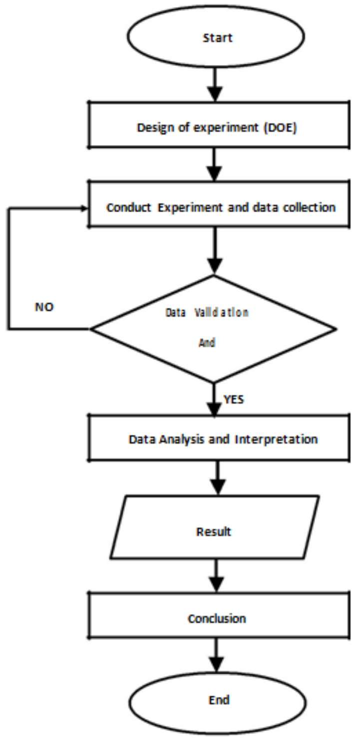
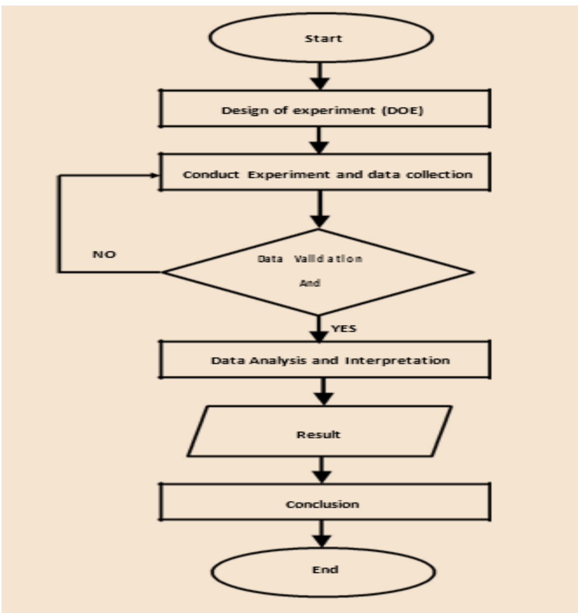


Base Metal

From the literature survey of past researchers it is show that the material selection in manufacturing process is most important think as per process availability and customer's requirement. There is number of material used in modern industry but steel have corrosion resistive property and high strength, so it is widely use in modern industry. The materials used to carry out experiment are AISI 410. The chemical composition and mechanical properties of AISI 410 are lioted Table 3.1and 3.2respectively.



Chemical Composition of AISI 410

Element	Weight %
C	0.08
Mn	1.00
Si	1.00
Cr	10.5-11.75
P	0.045
S	0.045
Ti	0.48-0.75

Mechanical properties of AISI 410

Density (× 1000 kg/m^3)	7.8
Elastic modulus (GPa)	190-210
Tensile strength (MPa)	450
Yield strength (MPa)	240
Elongation (%)	25
Hardness (HRB)	80 (max)

Electrode Size:

The electrode diameter influences the weld bead configuration (such as the size), the depth of penetration, bead width and has a consequent effect on the travel speed of welding. As a general rule, for the same welding current (wire feed speed setting) the arc becomes more penetrating as the electrode diameter decreases... The choice of the wire electrode diameter depends on the thickness of the work piece to be welded, the required weld penetration, the desired weld profile and deposition rate, the position of welding and the cost of electrode wire. Commonly used electrode sizes are (mm): 0.8, 1.0, 1.2, 1.6 and 2.4.

Welding Current:

The value of welding current used in MIG has the greatest effect on the deposition rate, the weld bead size, shape and penetration. In MIG welding, metals are generally welded with direct current polarity electrode positive (DCEP, opposite to TIG welding), because it provides the maximum heat input to the work and therefore a relatively deep penetration can be obtained. When all the other welding parameters are held constant, increasing the current will increase the depth and the width of the weld penetration and the size of the weld bead.

Welding Voltage:

The arc length (arc voltage) is one of the most important variables in MIG that must be held under control. When all the variables such as the electrode composition and sizes, the type of shielding gas and the welding technique are held constant, the arc length directly related to the arc voltage. High and low voltages cause an unstable arc. Excessive voltage causes the formation of excessive spatter and porosity, in fillet welds it increases undercut and produces narrower beads with greater convexity, but an excessive low voltage may cause porosity and overlapping at the edges of the weld bead.

Arc Travel Speed

The travel speed is the rate at which the arc travels along the work- piece. It is controlled by the welder in semiautomatic welding and by the machine in automatic welding. The effects of the travel speed are just about similar to the effects of the arc voltage. The penetration is maximum at a certain value and decreases as the arc speed is varied. For a constant given current, slower travel speeds proportionally provide larger bead and higher heat input to the base metal because of the longer heating time.

Welding Position

The position of the wire electrode with respect to the weld joint, affects the weld bead shape and the penetration to a greater extent than the arc voltage and the travel speed. The position of the wire electrodes is defined by means of two angles which are called “or” and “travel” angles.

Shielding Gas:

The primary function of shielding gas is to protect the arc and molten weld, pool from atmosphere oxygen and nitrogen. If not properly protected it forms oxides and nitrites and result in weld deficiencies such as porosity, slag inclusion and weldembrittlement. Arc characteristics, Mode of metal transfer, penetration and weld bead profile, speed of welding, cleaning of action, weld metal mechanical properties. Argon, helium and argon-helium mixtures are used in many applications for welding non-ferrous metals and alloys. Argon and Carbon dioxide are used in Carbon steel.

IV. DESIGN OF EXPERIMENT

Experiments are performed by investigators in all field of inquiry, usually to discover something about a particular process or system. Literally, an Experiment is a test. More formally, we can define an experiment as a test or series of test in which purposeful changes are made to the input variables of processor system so that we may observe and identify the reasons for changes that may be observed in the output response. When a large number of Experimental works have to be carried out when the number of the process parameters increases. Therefore to reduce the number of Experiments and to obtain good quality of investigation the term named Design of Experiments (D_OE) is getting familiar in all over the world. D_OE, is one of the most important statistical tools of TQM for designing high quality systems at reduced cost. (D_OE) methods provides an efficient and systematic way to optimize designs for performance, quality, and cost. (D_OE) is a systematic, rigorous approach to engineering problem-solving that applies principles and techniques at the data collection stage so as to ensure the generation of valid, defensible, and supportable engineering conclusions. In addition, all of this is carried out under the constraint of a minimal expenditure of engineering runs, time, and money. In industry, designed Experiments can be used to systematically investigate the processor product variables that influence product quality; you can direct improvement efforts to enhance a product manufacturability, reliability, quality, and field performance.

D_OE may be applicable in four general engineering areas:

1. Comparative

In this case, the engineer is interested in assessing whether a change in a single
Factor has in fact resulted in a change/improvement to the process as a whole.

2. Characterization

	Input Parameters
1	Travel speed (mm/min)
2	Current (Amp)
3	Voltage (V)
	Constant Parameters
1	Electrode size
2	Shielded Gas
	Output Parameter
1	Tensile strength (KN)

Welding parameters	Level 1	Level 2	Level 3
Voltage (V)	19	20	22
Travel speed(mm/min)	230	275	300
Current(amp)	3	4.5	7.5

Data Validation and Optimization

In this stage, the data collection must be through data validation process ensuring that that a study collect a clean, correct and useful data. Once surface roughness and hardness of welding beads experiments were completed results are analyzed by calculating the sigS/N ratio for each factor and each level in these experiments. This ratio is the reciprocal of the variance of the measurement error which is maximal for the combination of parameter levels that has the minimum error variance. Calculating the average of S/N value for each factor and plotting them for each level will reveals the effect of the factor on the variable used to evaluate these experiments on value of surface roughness and hardness. Analysis of variance (ANOVA) techniques will be used to study the fractional factorial experiments and identify the significance of each factor.

Single weld bead sample

There are 3 Signal-to-Noise ratios of common interest for optimization

- Smaller-The-Better:
  $n = -10 \, Log_{10}$ [mean of sum of squares of measured data]
- Larger-The-Better:
  $n = -10 \, Log_{10}$ [mean of sum squares of reciprocal of measured data]
- Nominal-The-Best:: $n = 10 \, Log_{10}$[square of mean variance]

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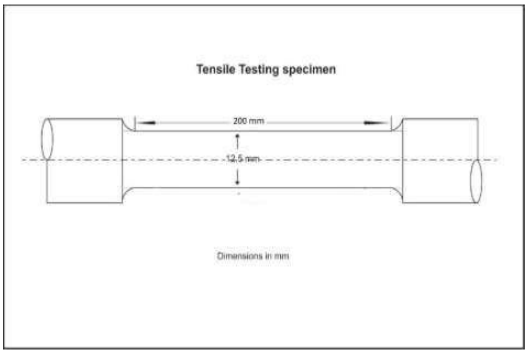
V. ULTIMATE TENSILE STRENGTH MEASUREMENT

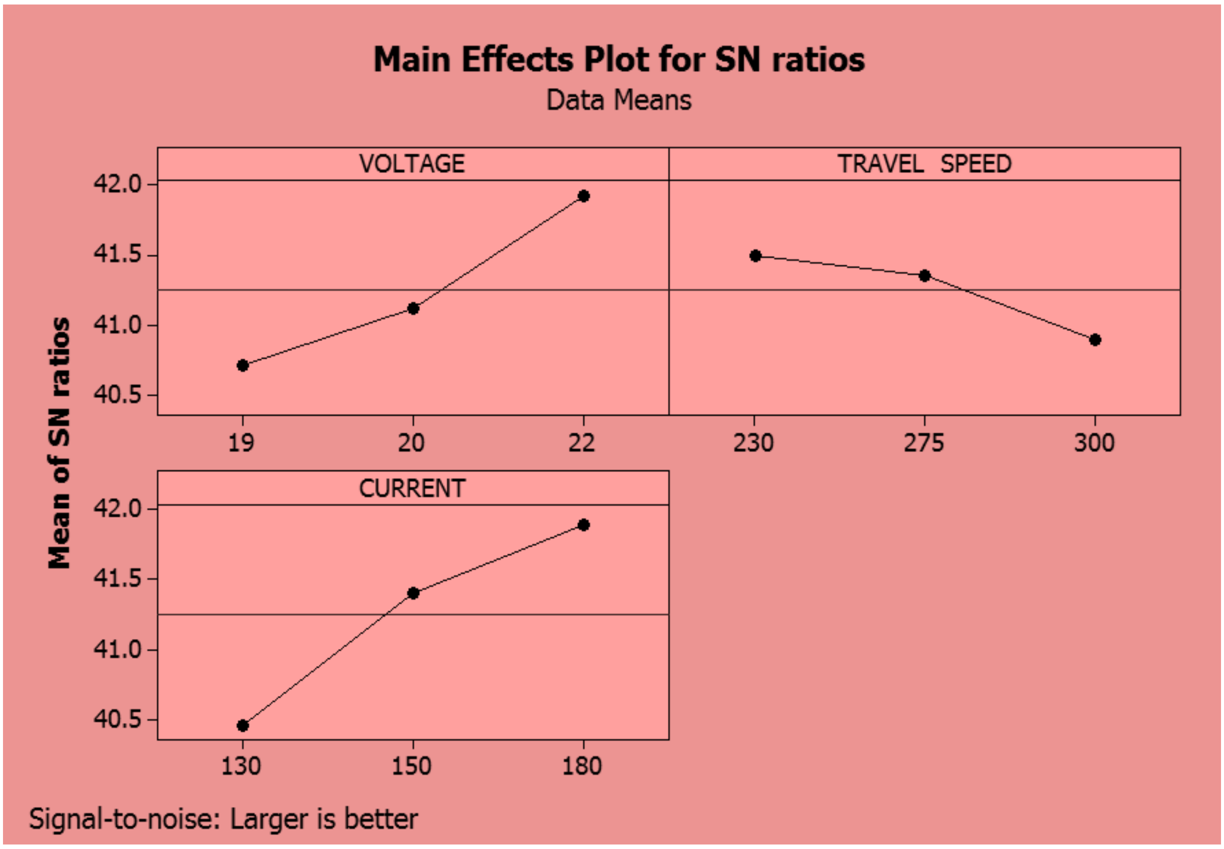
Tensile testing was done using ASME Section IX-2004 standards. The equipment used was a UTM Machine with a maximum capacity of 1000 kN. The welded specimen was prepared according to the procedures given in ASME Section ix-2004 and typical dimensions of the specimen



S.NO	Voltage (V)	Travel Speed(mm/min)	Current (amp)	Tensile Strength (ken)
1	19	230	130	102
2	19	275	150	110
3	19	300	180	114

Main effects plot of Ultimate tensile strength

The main effects plot for means of ultimate tensile strength travel speed, Current and Voltage, which is generate form the mean value of Tensile strength as per Table in Minitabe-17 statistical software is useful to find out optimum parameter value for response variable.



Main effects plot for means

Level	VOLTAGE	TRAVEL SPEED	CURRENT
1	108.7	119.7	105.7
2	114.3	117.0	117.7
3	125.0	111.3	124.7
Delta	16.3	8.3	19.0
Rank	2	3	1

Main effects plot for S/N ratio

Level	VOLTAGE	TRAVEL SPEED	CURRENT
1	40.71	41.50	40.45
2	41.12	41.35	41.40
3	41.92	40.90	41.89
Delta	1.21	0.60	1.44
Rank	2	3	1

ANOVA analysis of Ultimate tensile strength:

The purpose of the ANOVA is to investigate which process parameters significantly affect the performance characteristics. The ANOVA procedure performs analysis of variance (ANOVA) for balanced and unbalanced data from a wide variety of experimental designs. In analysis of variance, a continuous response variable, known as a dependent variable, is measured under experimental conditions identified by classification variables, known as independent variables. The variation in the response is assumed to be due to effects in the classification, with random error accounting for the remaining variation. In short the basic idea behind analysis of variance (ANOVA) is to breakdown total variability of the experimental results into components of variance, and then assesses their significance. The significance of the variation components associated with factor effects is assessed by comparison with the residual. The optimum level of these significant parameters was found by examining the level averages of the factors. The F-test was utilized for comparing variances for this purpose.

The following terms is used to prepare the ANOVA Tables.

Source - Indicates the source of variation, either from the factor, the interaction, or the error. The total is a sum of all the sources.

DF (Degrees of freedom) - If a factor has n levels, the degrees of freedom is (n1).

Sequential sums of squares (Seq SS) - The sequential sum of squares for each terming the model (factor or interaction) measures the amount of variation in the
Response that is explained by adding each term to the model sequentially in the order listed under source. Thus, the sequential sums of squares for terms are specific to the order of the terms specified in the linear model.

Adjusted sums of squares (Adj SS) - The adjusted sum of squares for a term in the model (factor or interaction) measures the amount of additional variation in the response that is explained by the term, given that all the other terms are already in the model. Thus, the values for the adjusted sums of squares do not depend on the order of the terms listed under source

Adjusted mean squares (Adj MS) - The adjusted mean square for a term is simply the adjusted sum of squares (Adj SS) divided by the degrees of freedom.

F-value (F) - The F value is calculated generally by dividing (MS source / MS error) or this can be thought of as the variance due to effect / variance due to error. An is equal to 1 would suggest that both the variance from effect and the variance from the error are equal or the same. This is very common and is usually associate with a very high probability that your result is due to chance. But if in case the Value is less than 1 suggesting that the variance due to error is higher than the variance due to source. The statistic that is used to test whether the effect of a term in the model (factor or interaction) is significant. F is used to determine the p-value.

(αalpha, α-level) -- When we conclude that there is a significant effect and there is not, we make a type I error. The probability of making a type I error is called alpha and is sometimes referred to as the level of significance.

p-value (P) - P is the probability that you would have obtained samples as extreme(or more extreme) if the indicated term (factor or interaction) has no effect on the response variable, If P is less than or equal to the α-Analysis for ultimate tensile strength verses gas presser, current and voltage by using Minitab 17 software

Analysis of Variance for Tensile strength, using adjusted AISI 410 for tests

S=2.30940 R-Sq=99.02% R-Sq(adj)=96.07%

Source	**DF**	**Seq SS**	**Adj SS**	**Adj MS**	**F**	**P**
Voltage	2	412.67	412.67	206.33	38.69	0.025
Travel speed	2	108.67	108.67	54.33	10.19	0.089
Current	2	554.00	554.00	277.00	51.94	0.019
Error	2	10.67	10.67	5.33		
Total	8	1086.00				

DF - degrees of freedom, SS - sum of squares, MS - mean squares(Variance), F-ratio of variance of a source to variance of error, P < 0.05 - determines significance of a factor at 95% confidence level

VI. CONCLUSION

In this present work, experiments are carried out for ultimate tensile strength with respect to variation of travel speed, current and voltage. There are 9 experimental readings taken for all variation of input parameter and they are use for conduct the parametric study for optimization of welding process parameter during welding of similar material like AISI410.The experimental result shows that the ultimate tensile strength is decrease with increase of the travel speed. It is show that the ultimate tensile strength is increase with increase of current value from 130 Amp to 180 Amp. Also from the experimental result it show that the ultimate tensile strength is increase initially with increase of voltage up to 22 Volt and then it decrease as increase the value of voltage. The ANOVA analysis also conducted to know the percentage contribution of the input parameter on output parameter. The parametric study indicate that the percentage contribution of travel speed is of 2.32 %, current is of 21.17 % and voltage is of 72.58 % for ultimate tensile strength, which shows that the voltage is most significant parameter for ultimate tensile strength of similar material welding and it is followed by welding current and travel speed in MIG welding.

REFERENCES

1. Bendell, j. Disney, W.A. Pridmore1989*Taguchi Methods: Application in WorldIndustry*UKIFS Publication.
2. Tradia, F.Roger, E. Guyot2010Optimal parameter for pulsed gas tungsten arc welding in partially and fully penetrated weld pools *International Journal of ThermalSciences49*1197-1208
3. Ajit Hooda1*, A. D. (2012). OPTIMIZATION OF MIG WELDING PROCESS PARAMETERS TO PREDICT MAXIMUM YIELD STRENGTH IN AISI 1040.
4. C.E. Bull, K.A. Stacey, R. Calcraft1993On line weld monitoring using ultrasonic. Nondestructive Testing*35 (2) 57–64.*
5. Dongjie Li, Shanping Lu, Wenchao Dong, Dianzhiong Li, Yiyi Li20126 Study of the law between the weld pool shape variations with the welding parameters under two TIG processes*MaterialsProcssing Technology*128-136
6. *Engineering Materials: Properties and Selection*1999Prentice Hall
7. Global versus cluster-wise regression analyses for prediction of bead geometry in MIG welding process *Journal of Materials Processing Technology 189 (2007) 352–366*2006