

# **Influence of Wire Feed Rate and Wire Tension in Wire Electrical Discharge Machining of Titanium Alloy**

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**ABSTRACT:** Wire Electrical Discharge Machining (WEDM) is extensively used for machining of complex shapes in the field of die and mould making, medical, aerospace and automobile industries. Improper selection of wire electrical discharge machining process parameters setting can affect the machining efficiency and surface roughness due to arcing phenomenon that lead by discharge point of focus. The present study has been made to study the influence of WEDM process parameters such as wire feed rate and wire tension during machining of Ti-6Al-4V Titanium alloy by WEDM process and these parameters were optimized using Response Surface Methodology (RSM). The analysis of variance (ANOVA) was carried out to study the effect of process parameters on process performance. The mathematical models are also developed for process performance measures such as kerf width, material removal rate (MRR), surface roughness, cutting rate and overcut and validated with the experimental results.

**KEYWORDS:** Wire EDM, Kerf width, MRR, Surface roughness, over cut, ANOVA

## **I. INTRODUCTION**

Wire Electrical Discharge Machining (WEDM) technology has been widely used in tool and die-making industry, automotive, medical and practically any conductive materials. It is a non-traditional machining process which used the continuously circulating wire as electrode and cuts the work piece along a programmed path. In WEDM, a thin single-strand metal wire is fed through the work piece submerged in a tank of dielectric fluid. WEDM is typically used to make punches, tools, and dies from hard metals that are difficult to machine with other methods. WEDM is commonly used when low residual stresses are desired, because it does not require high cutting forces for removal of material. If the energy per pulse is relatively low, little change in the mechanical properties of a material is expected due to these low residual stresses, although material that has not been stress-relieved can distort in the machining process. The work piece may undergo a significant thermal cycle, its severity depending on the technological parameters used. Such thermal cycles may cause formation of a recast layer on the part and residual tensile stresses on the work piece.

Titanium alloys are hard metals which contain a mixture of titanium and other chemical elements. Ti-6Al-4V grade titanium alloy is the most popular titanium alloy and is used for a range of applications in the aerospace, marine, power generation and offshore industries. Titanium alloys have very high tensile strength, fatigue resistance, light in weight (highest strength-to-weight ratio), extraordinary corrosion resistance, toughness even at elevated temperatures and able to withstand high temperatures. However, the high cost of both raw materials and processing limit their use to military applications, aircraft, spacecraft, medical devices, connecting rods on expensive sports cars and some premium sports equipment and consumer electronics. Auto manufacturers Porsche and Ferrari also use titanium alloys in engine components due to its durable properties in these high stress engine environments.

Although "commercially pure" titanium has acceptable mechanical properties and has been used for orthopedic and dental implants, for most applications titanium is alloyed with small amounts of aluminum and vanadium. This mixture has a solid solubility which varies dramatically with temperature, allowing it to

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undergo precipitation strengthening. This heat treatment process is carried out after the alloy has been worked into its final shape but before it is put to use, allowing much easier fabrication of a high-strength product. Yang, X, Liu, CR et al., studied the machining of titanium and its alloys (1), Kuriakose, Sh, Shanmugan MS et al., studied the characteristics of wire electro discharge machined Ti 6Al 4V surface (2) and Rahman.M.M et al., have done the modeling of machining parameters of Ti 6Al 4V for electric discharge machining using a neural network approach (3). Titanium and its alloys are attractive and important materials in modern industry due to their unique properties. Titanium is a very strong and light metal. This property causes that titanium has the highest strength-to-weight ratio in comparison the other metal that are studied to medical use. Titanium is also incredibly durable and long-lasting. When titanium cages, rods, plates and pins are inserted into the body, they can last for upwards of 20 years. Titanium non-ferromagnetic property is another benefit, which allows patients with titanium implants to be safely examined with MRIs and NMRI's (4, 5). Titanium and its alloys are used in many different industries such as biomedical applications, automobile, aerospace, chemical field, electronic, gas and food industry (6). In recent decades, titanium is applied widely in biomedical and medical field because it is absolutely a proper joint with bone and other body tissue, immune from corrosion, strong, flexible and compatible with bone growth. Titanium is used in different medical applications such as dental implants, hip and knee replacement surgeries, external prostheses and surgical instruments (4, 7). Elias C.N et al., studied the Bio Medical applications of Titanium and its alloy (8) and Kumar A et al., has done the investigations into machining characteristics commercially pure titanium using CNC electric discharge machining (9). On the other hand, there is some limitation for titanium use because of its initial high cost, availability, inherent properties and manufacturability (9). Machining titanium and its alloys by conventional machining methods has some difficulties such as high cutting temperature and high tool wear ratio. Thus, titanium and its alloys are difficult-to-machine through conventional machining process. Therefore, unconventional machining processes are introduced for machining titanium and its alloys (2, 6). Gu.L and Rajukar K.P et al., studied the electric discharge machining of Titanium alloy (Ti-6Al-4V) with a bundled electrode.

Manna and Bhattacharyya (10) studied wire electric discharge machining of aluminium-reinforced silicon carbide metal matrix composite and identified that wire tension and wire feed rate were the most significant machining parameters, for the surface roughness. Ramakrishnan and Karunamoorthy (11) described the multi objective optimization of the WEDM process using parametric design of Taguchi methodology and identified that the pulse on time and ignition current intensity has influence more than the other parameters. Sarkar et. al. (12) developed a feed forward back-propagation neural network model for and observed that the surface quality decreased as the cutting speed increased and it varies almost linearly up to a surface roughness value of 2.44  $\mu\text{m}$  and a cutting speed of 2.65 mm/min. Kanlayasiri and Boonmung (13) investigated influences of wire electrical discharge machining variables on surface roughness of newly developed DC 53 die steel and found that pulse-on time and pulse-peak current were significant variables to the surface roughness of wire electric discharge machined die steel. Rupesh Chalisgaonkar et. al. (14) analyzed the process capability in wire EDM of commercially pure Titanium and the process capability index was evaluated for machining characteristics such as machined work-piece dimension and surface roughness.

## II. MATERIALS AND METHODS

The experiments were conducted on ULTRACUT S1 Four Axis Wire Cut EDM machine from Electronica India Pvt. Ltd. The titanium alloy of Ti-6Al-4V was used as work piece material for the present Investigations. The chemical composition of Ti-6Al-4V titanium alloy by % weight is given in Table I. A diffused brass wire of 0.3 mm diameter was used as the wire electrode due to its extreme properties like electric discharge performance, heat resistance, low calorification and heat release. The chemical composition of brass wire was 63% copper and 37% Zinc by weight and its tensile strength is 142000 PSI. The deionized water was used as dielectric because of its low viscosity and rapid cooling rate and its temperature was kept at 20°C. The process parameters such as wire feed rate and wire tension has taken at three different levels as shown in Table II and the other parameters, pulse on time (110  $\mu\text{s}$ ), pulse off time (50 $\mu\text{s}$ ), pulse peak current (12 machine units), servo voltage (50V), dielectric fluid pressure (10 kgf/cm<sup>2</sup>) and servo feed rate (2050) are taken at constant. The experiments were conducted on ULTRACUT S1 Four Axis Wire EDM machine with brass electrode of diameter 0.3 mm. The selections of these factors were based on the suggestions from the handbook recommended by the machine manufacturer, preliminary research results and journals. The kerf width

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was measured with optical microscope with magnification of 100X. Ten readings at different ten spots were taken and their average has been considered as kerf width of the cutting slot. MRR is calculated by considering the kerf width, cutting speed and thickness of workpiece. The surface roughness was measured with S1500DX/SD2 model SURFCOM with sensitivity of ½ Max and at magnification of X10000. Cutting rate is directly noted from the display parameters of wire electric discharge machine. The over cut is calculated as difference of kerf width and wire diameter. The influence of wire EDM process parameters such as wire feed rate and wire tension on process performance measures of kerf width, MRR, surface roughness, cutting rate and over cut have been investigated.

Table I. Chemical composition of Ti-6Al-4V Titanium alloy

C	Fe	Al	O <sub>2</sub>	N <sub>2</sub>	V	H <sub>2</sub>	Ti
0.08	0.22	6.08	0.02	0.05	4.02	0.15	Balance

Table II. Test Conditions

Process Parameter	L1	L2	L3
Wire Feed Rate (WFR) (m/min)	5	10	15
Wire Tension (WT) (kgf)	1.1	1.3	1.5

### III. RESULTS AND DISCUSSIONS

#### A. Kerf width

Response surface methodology approach is the procedure for determining the relationship between various process parameters with various machining criteria and exploring the effects of these process parameters on the coupled responses (15). Design of Experiments (Three level response surfaces) was used to predict the significant effects and their interactions of the two important Wire EDM machining parameters i.e. wire feed rate and wire tension on various response variables such as kerf width, MRR, surface roughness, cutting rate and over cut and these responses were modelled using Design of Experiments (DOE) software (Design Expert 7) by taking two factors, wire feed rate and wire tension at three levels i.e. 5, 10 and 15 m/min and 1.1, 1.3 and 1.5 kgf respectively. The optimum values of selected variables were obtained by solving the regression equations and by analyzing the response surface contour plots. Analysis of variance (ANOVA) was used to analyze the experimental data and the relative significance of the machining parameters viz. wire feed rate and wire tension with respect to the measure of performance was investigated. The analysis of variance based on partial sum of squares is shown in table III.

Table. III Analysis of variance (ANOVA) for Kerf width

Source	Sum of Squares	df	Mean Square	F Value	p-value, Prob > F
Model	0.000561	2	0.00028	53.67485	< 0.0001
A-Wire Feed Rate	0.000368	1	0.000368	70.47117	< 0.0001
B-Wire Tension	0.000193	1	0.000193	36.87853	0.0001
Residual	5.22E-05	10	5.22E-06		

The Model F-value of 53.67 implies the model is significant. There is only a 0.01% chance that a "Model F-Value" this large could occur due to noise. Values of "Prob > F" less than 0.05 indicate model terms are significant. In this case wire feed rate and wire tension are significant model terms. "Adeq Precision" measures the signal to noise ratio. The ratio of 24.590 indicates an adequate signal. This model can be used to navigate the design space.  
Kerf width = 0.320115 + 0.001567 \* WF + 0.028333 WT

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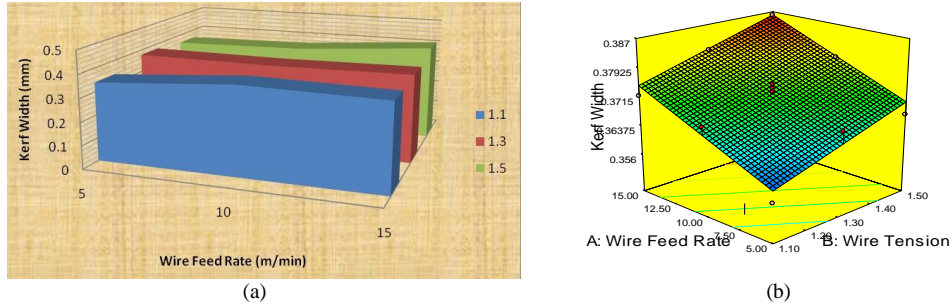


Fig. 1 (a) Wire Feed Rate and Wire Tension Vs. Kerf width (b) Design Expert Response surface plot for Kerf width

The experimental results reveals that as the wire feed rate and wire tension increases, the kerf width also increases, as shown in Fig. 1(a) and we observed the same through design expert response surface plot, as shown in Fig. 1 (b). Further it is observed that the influence of wire feed rate and wire tension is very little on kerf width.

## B. Material Removal Rate (MRR)

The material removal rate is calculated by taking the over cut into consideration as; Material Removal Rate ( $\text{mm}^3/\text{min}$ ) =  $CS \times K_w \times t$ , Where 'CS' is the cutting speed in ( $\text{mm}/\text{min}$ ), 'Kw' is the kerf width in (mm) and 't' is the work piece thickness in (mm). Analysis of variance (ANOVA) was used to analyze the experimental data and the relative significance of the machining parameters viz. Wire feed rate and wire tension with respect to the MRR was investigated. The analysis of variance based on partial sum of squares for material removal rate is shown in table IV.

Table IV. Analysis of variance (ANOVA) for Material Removal Rate

Source	Sum of Squares	df	Mean Square	F Value	p-value, Prob > F
Model	0.081837	3	0.027279	27.12621	< 0.0001
A-Wire Feed Rate	0.02394	1	0.02394	23.8062	0.0009
B-Wire Tension	0.04524	1	0.04524	44.987	< 0.0001
AB	0.012656	1	0.012656	12.58543	0.0062
Residual	0.009051	9	0.001006		

The Model F-value of 27.13 implies the model is significant. There is only a 0.01% chance that a "Model F-Value" this large could occur due to noise. Values of "Prob > F" less than 0.0500 indicate model terms are significant. In this case wire feed rate, wire tension and their interaction are significant model terms. "Adeq Precision" measures the signal to noise ratio. The ratio of 17.055 indicates an adequate signal. This model can be used to navigate the design space.  
 $MRR = 2.716962 - 0.06049 * WF - 0.12833 * WT + 0.05625 * WF * WT$

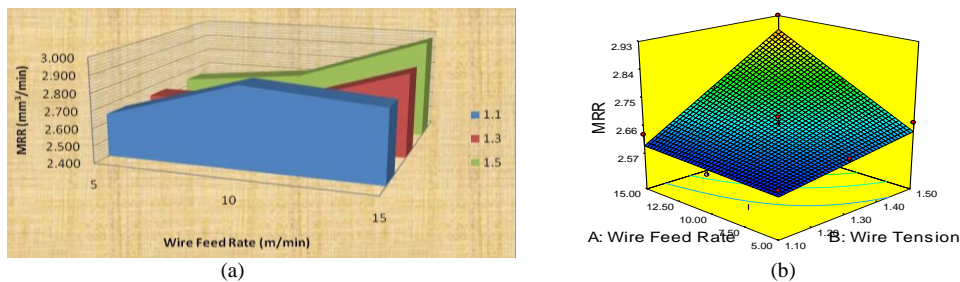


Fig. 2 (a) Wire Feed Rate and Wire Tension Vs. MRR (b) Design Expert Response surface plot for MRR

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The experimental results reveals that as the wire feed rate and wire tension increases, the material removal rate also increases, as shown in Fig. 2(a) and we observed the same through design expert response surface plot, as shown in Fig. 2(b). However, for extended wire feed rate and wire tension the material removal rate decreases.

### C. Surface Roughness

The surface roughness was measured with S1500DX/SD2 model SURFCOM with sensitivity of 1/2 Max and at magnification of X10000. Analysis of variance (ANOVA) was used to analyze the experimental data and the relative significance of the machining parameters viz. wire feed rate and wire tension with respect to the surface roughness was investigated. The analysis of variance based on partial sum of squares for surface roughness is shown in table V.

Table V. Analysis of variance (ANOVA) for Surface Roughness

Source	Sum of Squares	df	Mean Square	F Value	p-value, Prob > F
Model	0.361785	5	0.072357	5.803243	0.0197
A-Wire Feed Rate	0.002128	1	0.002128	0.170685	0.0419
B-Wire Tension	0.04352	1	0.04352	3.490444	0.0439
AB	0.023562	1	0.023562	1.889761	0.2116
A <sup>2</sup>	0.113757	1	0.113757	9.12367	0.0194
B <sup>2</sup>	0.068903	1	0.068903	5.526226	0.0510
Residual	0.087279	7	0.012468		

The Model F-value of 5.80 implies the model is significant. There is only a 1.97% chance that a "Model F-Value" this large could occur due to noise. Values of "Prob > F" less than 0.05 indicate model terms are significant. In this case wire feed rate, wire tension and square of wire feed rate are significant model terms. "Adeq Precision" measures the signal to noise ratio. The ratio of 7.140 indicates an adequate signal. This model can be used to navigate the design space. Surface Roughness = 10.56319 - 0.25837\*WF - 10.6083\*WT + 0.07675\*WF\*WT + 0.008118\*WF<sup>2</sup> + 3.948707\*WT<sup>2</sup>

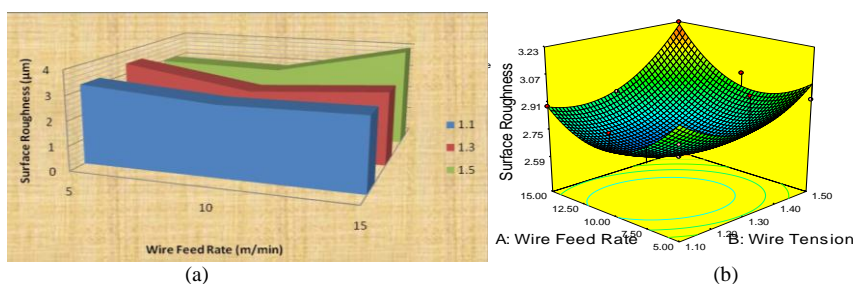


Fig. 3 (a) Wire Feed Rate and Wire Tension Vs. Surface Roughness (b) Design Expert Response surface plot for Surface Roughness

Form the experimental results, it is observed that the surface roughness is too high at low and high values of wire feed rate and wire tension and the surface roughness is moderate at medium values of wire feed rate and wire tension, as shown in Fig. 3(a). We observed the same through design expert response surface plot for surface roughness, as shown in Fig. 3(b). However, it is observed that as the wire tension increases, it reduces the vibrations of wire and causes reduction in surface roughness and improves the quality of the machined surface.

### D. Cutting Rate

The cutting speed has been directly noted from the parameters display of Wire Electrical Discharge Machine. Analysis of variance (ANOVA) was used to analyze the experimental data and the relative significance of the machining parameters viz. Wire feed rate and wire tension with respect to the cutting rate was investigated.

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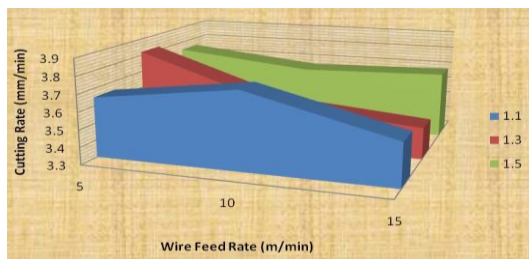
The analysis of variance based on partial sum of squares for cutting rate is shown in table VI.

Table VI. Analysis of variance (ANOVA) for Cutting Rate

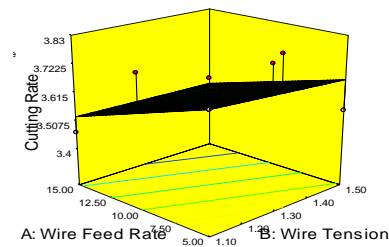
Source	Sum of Squares	df	Mean Square	F Value	p-value, Prob > F
Model	0.122003	2	0.061002	9.422219	0.0050
A-Wire Feed Rate	0.100881	1	0.100881	15.58186	0.0027
B-Wire Tension	0.021123	1	0.021123	3.262573	0.0110
Residual	0.064742	10	0.006474		

The Model F-value of 9.42 implies the model is significant. There is only a 0.50% chance that a "Model F-Value" this large could occur due to noise. Values of "Prob > F" less than 0.05 indicate model terms are significant. In this case wire feed rate and wire tension are significant model terms. "Adeq Precision" measures the signal to noise ratio. The ratio of 9.779 indicates an adequate signal. This model can be used to navigate the design space.

$$\text{Cutting Rate} = 4.241846 - 0.02593 * \text{WF} - 0.29667 * \text{WT}$$



(a)



(b)

Fig. 4(a) Wire Feed Rate and Wire Tension Vs. Cutting Rate (b) Design Expert Response surface plot for Cutting Rate

From the experimental results it is observed that the cutting rate decreases as the wire feed rate increases, as shown in Fig. 4(a) and confirmed the same through design expert response surface plot, as shown in Fig. 4(b). Further, it is observed from the design expert response surface plot that the wire tension have no significant effect on cutting speed, as shown in Fig. 4(b). Farnaz Nourbakhsh and K. P. Rajurkar et al., are also proved the same (16).

### E. Over cut

The difference between the kerf width and diameter of wire is termed as 'over cut'. Over cut has been determined with the difference of kerf width and wire diameter. Analysis of variance (ANOVA) was used to analyze the experimental data and the relative significance of the machining parameters viz. Wire feed rate and wire tension with respect to the over cut was investigated. The analysis of variance based on partial sum of squares for over cut is shown in table VII.

Table VII. Analysis of variance (ANOVA) for Over Cut

Source	Sum of Squares	df	Mean Square	F Value	p-value, Prob > F
Model	0.000561	2	0.00028	53.67485	< 0.0001
A-Wire Feed Rate	0.000368	1	0.000368	70.47117	< 0.0001
B-Wire Tension	0.000193	1	0.000193	36.87853	0.0001
Residual	5.22E-05	10	5.22E-06		

The Model F-value of 53.67 implies the model is significant. There is only a 0.01% chance that a "Model F-Value" this large could occur due to noise. Values of "Prob > F" less than 0.05 indicate model terms are significant. In this case wire feed rate and wire tension are significant model terms. The ratio of 24.590 indicates an adequate signal. This model can be used to navigate the design space.

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$$\text{Over Cut} = 0.020115 + 0.001567 * \text{WF} + 0.028333 * \text{WT}$$

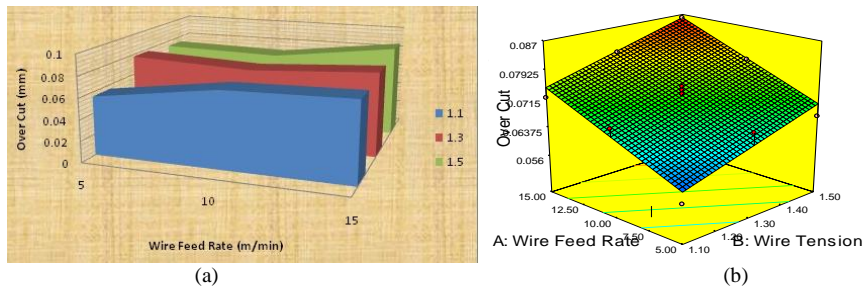


Fig. 5 (a) Wire Feed Rate and Wire Tension Vs. Over Cut (b) Design Expert Response surface plot for over cut

The reason that the cutting width is greater than the width of the wire is because of sparking occurs from the sides of the wire to the work piece, causing erosion. The experimental results reveal that the overcut increases as the wire tension increases, as shown in Fig. 5(a) and we observed the same through design expert response surface plot, as shown in Fig. 5(b). However, the over cut is more at high and low values of wire feed rate.

## IV. CONCLUSIONS

In this study, the influence of wire EDM parameters (wire feed rate & wire tension) on kerf width, MRR, surface roughness, cutting rate and over cut has been studied. Based on the experimental results and design of experiments (RSM) the following conclusions were made:

- It is observed that as the wire feed rate and wire tension increases, the kerf width and material removal rate are increases, but the influence of wire feed rate and wire tension is very little on kerf width. However, for extended wire feed rate and wire tension the material removal rate decreases.
- It is observed that the surface roughness is too high at low and high values of wire feed rate and wire tension and the surface roughness is moderate at medium values of wire feed rate and wire tension. However, it is observed that as the wire tension increases, it reduces the vibrations of wire and causes reduction in surface roughness and improves the quality of the machined surface.
- It is observed that the cutting rate decreases as the wire feed rate increases and the wire tension have no significant effect on cutting speed. The overcut increases as the wire tension increases and the over cut is more at high and low values of wire feed rate.

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## REFERENCES

- [1] Yang, X., Liu, C.R., "Machining Titanium and Its Alloys", Machining Science and Technology, 3(1), pp. 107-139, 1999.
- [2] Kuriakose, Sh., Shunmugam, M.S., "Characteristics of WEDMed Ti6Al4V Surface", Science Direct (Elsevier) 58, pp. 2231- 2237, 2004.
- [3] Rahman, M.M., "Modeling of Machining Parameters of Ti-6Al-4V for EDM" Scientific Research and Essays, 7 (8), pp. 881-890, 2012.
- [4] www.titanium.org, International Titanium Association-Medical Data Sheet, 1999.
- [5] <http://www.supralloys.com>.
- [6] Gu, L. et.al "EDM of Ti6Al4V with a Bundled Electrode", Int. Jr. of Machine Tools and Mfg., 53 (1), pp. 100-106, 2012.

## International Journal of Innovative Research in Science, Engineering and Technology

*(A High Impact Factor, Monthly Peer Reviewed Journal)*

**Vol. 5, Issue 1, Januray 2016**

- [7] www.titaniuminfogroup.co.uk, Titanium for Medical Application, 1<sup>st</sup> August, 2001.
- [8] Elias, C.N and Lima,J.H.C et. al. , “Biomedical Applications of Titanium and its Alloys” Biological Materials Science 60(3), pp. 46-49, 2008.
- [9] Kumar, A. et. al , “An Investigation into Machining Characteristics Pure Titanium Using WEDM” Appl. Machines & Materials, pp. 56-68, 2012.
- [10] Manna and Bhattacharyya, “A study on different tooling systems during machining of Al/SiC-MMC”, Journal of Materials Processing Technology, Volume 123, Issue 3, pp 476-482, 2002.
- [11] R. Ramakrishnan and L. Karunamoorthy, “Modeling and multi-response optimization of Inconel 718 on machining of CNC WEDM process”, Journal of Materials Processing Technology, Vol. 207, Issues 1–3, pp 343-349, 2008.
- [12] Sarkar S et. al “Modeling and optimization of wire electrical discharge machining of  $\gamma$ -TiAl in trim cutting operation”, Journal of Material Processing Technology, 205(1–3), pp. 376–387, 2008.
- [13] K. Kanlayasiri and S. Boonmung, “Effects of wire-EDM machining variables on surface roughness of newly developed DC 53 die steel: DOE and regression model”, Journal of Materials Processing Technology, Vol. 192–193, pp. 459-464, 2007.
- [14] Rupesh Chalisgaonkar et. al., “Process Capability Analysis & Optimization in WEDM of Pure Titanium”,Procedia Engg, V97, pp.758-766, 2014.
- [15] Myers RH and Montgomery DC., RSM: process and product optimization using DOE 2nd ed. New York: 2002.
- [16] Nihat Tosun, Can Cogun and Gul Tosun, “A study on kerf and MRR in wire electrical discharge machining based on Taguchi method”, Journal of Materials Processing Technology, Vol. 152, Issue 3, pp. 316-322, 2004.

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