Investigation on Machinability of Aluminum 7075 Under Dry Environment

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Aluminum is a light and soft material that is difficult to machine. It is the most produced non-ferrous metal and undergoes extensive machining for the development of a wide range of products. Advances in industry inspire the need to find sustainable ways of machining aluminum and its alloys using conventional machining processes. In the study reported in this paper, two sets of experiments were conducted to investigate the machinability of aluminum 7075 using a plain carbide tool under a dry environment, i.e., no lubrication. In the first set, four rough experiments were conducted where three important machining parameters, i.e., cutting speed CS (115-495 RPM), depth of cut DOC (0.8-1.5 mm), and Feed rate FR (0.08-0.2 mm/rev) have been varied at two levels each to check the behavior of responses or machinability indicators, i.e., surface roughness and tool wear, at machining parameters' highest and lowest values. Based on the results of the first set of experiments, the ranges and levels of parameters have been fixed in the second set for a detailed study of the machinability of aluminum. A total of nine experiments based upon Taguchi's robust design of experiment technique with orthogonal array L9 have been conducted where an additional machining parameter, i.e., machining time MT, has been introduced. The effect of machining parameters on tool wear and surface roughness has been studied in detail, and it is found that the dry machining of aluminum is possible without the early failure of the tool. Dry machining with low values of CS, DOC, FR, and medium MT is desirable for better machinability, i.e., minimum roughness and tool wear, an optimum combination of machining parameter cutting speed- 115 RPM, depth of cut- 0.8 mm, feed rate- 0.12 mm/rev, and machining time- 90 seconds. The findings of the present work will assist engineers and researchers in attaining quality, productivity, and sustainability while manufacturing parts and components from aluminum to be used in the automotive, defense, and aerospace sectors.

Keywords: *Aluminum; Chip; Dry cutting; Machinability; Tool wear; Surface quality*

1. INTRODUCTION

Machining is the mechanical removal of unwanted material from a workpiece to achieve a finished product of the desired shape and size [1]. It is commonly used for the final product finishing of castings and formed parts. Over the years, conventional machining processes have maintained their relevance and importance in emerging and long-existing industries. It is important to dissect these processes to highlight their relevance in the machining industry. Studies have been conducted through vigorous research and experimentation to optimize machining processes and keep a low environmental impact, all the while ensuring an economical alternative to industries. These techniques have aided industries in maximizing their profits by optimizing their manufacturing processes. It is worth noting that with the findings from research, new exploits of materials that were otherwise considered impossible to machine have been uncovered. All this is influenced by the various new applications that come with the growth in the automobile, aerospace, and other manufacturing industries. The cost of cutting tools and that of the part are two of the most important factors when it comes to manufacturing costs. It is also equally as important to understand the selected machining process and its workings for cost-efficient production. The required surface quality of machined products is of vital importance in determining the viability of the selected machining process [2, 3]. This enables engineers to control and manage industrial procedures through research and experimentation for process optimization.

All materials have to undergo a substantial amount of machining during the development of products from them. Turning is one of the oldest machining methods where material removal from a cylindrical workpiece is achieved using a single-point cutting tool insert. Plain tungsten carbide inserts are the most extensively used

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tool due to their low cost. In turn, process parameters, namely, cutting speed (CS), feed rate (FR), and depth of cut (DOC), are the most important and largely affect the machinability of any material. The important machinability indicators are the surface roughness of the machined material, tool wear, material removal rate, etc. Mostly, plain turning is done using plain carbide tools and hydrocarbon-based cutting fluids. These cutting fluids are very harmful to the environment, and ample attempts are being made to find alternates between these cutting fluids and traditional flood cooling type lubrication techniques [4]. Dry cutting is one such attempt where no lubricant or coolant is used in machining. Some alternate strategies, i.e., green lubrication, coated tools, textured tools, etc., can be combined with dry machining. To measure the success of dry machining, it is important to conduct studies on the effect of machining parameters, under a dry environment, on machinability indicators.

Aluminum, which remains one of the most abundant materials in the earth's crust in the range of 8% in its raw form of bauxite (aluminum ore), is a light material that is difficult to machine. It is the third most abundant in its natural form and is combined with oxygen and other elements to produce parts and structures for high-strength applications in aerospace, scientific, instrumentation, and automobile sectors [5]. Its machining is challenging due to its fusion or chipping on the tool cutting edge, i.e., high built-up edge formation and tendency to yield under–cutting tool pressure because of its low elastic modulus, etc. Conventionally, it is machined under the influence of flood cooling with hyd–rocarbon-based cutting fluids. This method produces extensive environmental foot–prints. Some of the past attempts at machining aluminum are discussed here as under.

A group of researchers investigated minimizing surface roughness and roundness error and maximizing the material removal rate for machinability enhan–cement of AA6063 T6 Aluminum alloy [3]. They found that FR affects machining at 57.365%, DOC at 25.11%, and CS at 17.35%. These experimental results yielded a Grey Relational Grade (GRG) of 0.7717 with the best performance parameters obtained at a CS of 119.22 m/min, FR of 0.05 mm/rev, and DOC of 0.15mm. In an important investigation, a successful optimization of machining parameters for machinability enhancement of 6026-T9 was done by Abas et al. [6]. They used olive oil under minimum quantity lubrication conditions and extended tool life, and improved material removal rate at a cutting speed of 500 m/min, a feed rate of 0.3 mm/rev, a depth of cut of 2 mm, positive tool rake angle of 15°, and 150 ml/hr oil flow rate. Another study reports the use of a diamond tool insert for the rough turning of a modified aluminum RSA 905 [7]. The feed rate was found as the most significant parameter that affected tool wear. The optimal machining conditions for higher productivity are 15 mm/min feed rate, depth of cut 25 um, and cutting speed of 2000 rpm. Cakir et al. [8] conducted minimum quantity lubrication-based turning of AA7075 and AA2024 aluminum alloys. Improved work surface quality was obtained with increased flow rate and decreased feed and cutting speed. A group of rese–archers recommended poly–crystalline diamond cutting tool inserts for machining rolled aluminum under a dry environment [9]. Ariff and Sofian observed higher tool wear during the dry mac–hining of T6061 aluminum using Titanium carbonitride-coated inserts [10]. Textu–red tools were also found effective for machinability enhancement of aluminum alloys [11]. Researchers also found a wide range of optimization techniques effective indeed to overcome the challenges related to the machining of aluminum and its alloys [12-14].

The review of past work indicates that there is a need to make more research attempt on dry machining of 7075 Aluminum type important lightweight mate–rials. The work presented in this paper fulfills that gap by discussing the results of a study consisting of two sets of experiments conducted to investigate the machi–nability of Aluminum 7075 using plain tungsten carbide tool inserts under a dry environment. Our aim is to explore and establish dry machining as a sustainable technique to enhance the machinability of Aluminum type lightweight material to obtain better quality parts with low consumption of resources and less environ–mental footprints.

2. EXPERIMENTAL DETAILS

Two stages of experiments, i.e., set 1 and set 2, have been conducted to investigate machinability by analyzing the occurrence of tool wear, the surface roughness of the machined workpiece, and the effects of input process parameters in dry machining of aluminum 7075. The presence of both flank and crater wear has been found. The experiments were conducted using the Colchester Mascot 1600 center lathe machine, consi–dering cutting speed (CS), feed rate (FR), and depth of cut (DOC) as important input machining parameters under a dry environment. It was necessary to investigate the cutting behavior of aluminum by set 1 experiments. For the set 1 experiment, all three machining parameters were varied at two levels each, i.e., cutting speed at 115 and 495 RPM, depth of cut at 0.8 and 1.5 mm, and feed rate at 0.08 and 0.2 mm/rev, to investigate their effects on machinability of aluminum, especially tool wear. Based upon the outcomes of the set 1 experiment, all three machining parameters and cutting or machining time (MT) in seconds were varied at three levels each during set 2 experiments for a detailed study on the machinability of aluminum.

The machinability of a material is a measure of how machining parameters perform during machining. The present study is focused on surface roughness and tool wear. In this work, the average roughness (R_a) and maximum peak-to-valley height or maximum roughness (R_{max}) have been considered. The surface roughness readings are taken using the portable surface roughness tester with the machined component still fixed in the machine chucks. This is done to eliminate errors in alignment for the machining operations, which are often a cause for concern with the removal of workpieces from the machining chuck. For tool wear, the study focuses on maximum flank wear and crater wear. Flank wear is adjacent to the tool contact layer and, as such, influences the quality of the machined surface finish,

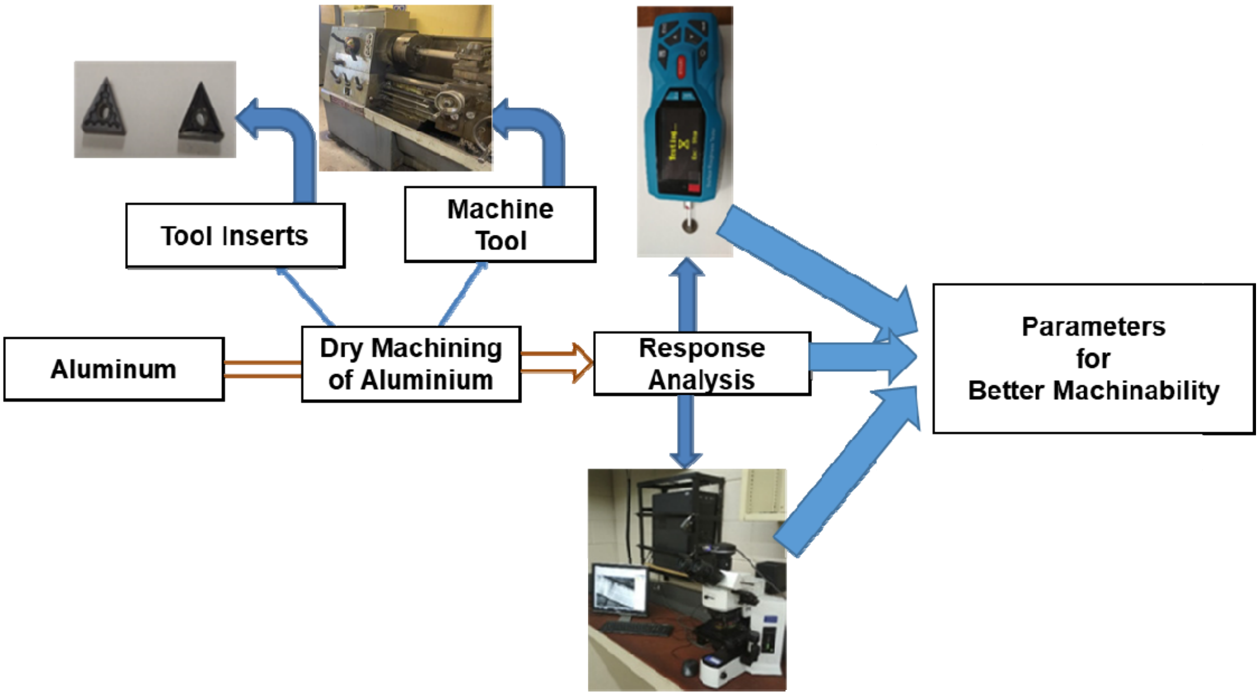


Figure 1. Process sequence to investigate dry machining of aluminum.

and crater wear is a direct result of the contact with the metal chips produced by the machining action, which are plugging away at the material on the cutting tool surface. Wear is measured with the help of an optical microscope.

For the chip, normal camera pictures were taken. Figure 1 shows the machining sequence and the specific tools to be used in conducting the experiments. An optical microscope has been used to investigate the tool wear and chips.

3. RESULTS AND DISCUSSION

Table 1 presents the results of set 1 experiments. Figures 2 and 3 show the optical micrographs of flank wear and crater wear, respectively. Fig 4 presents the actual pictures of chips generated during set 1 experiments.

Table 1. Machining parameter combinations and corres–ponding values of machinability indicators for set 1 expe–rimental stage.

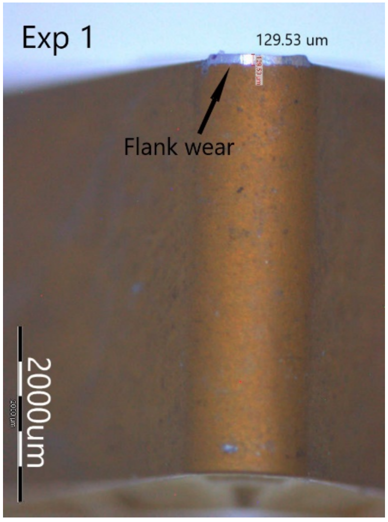
	Input parameters			Output parameters			
	CS rpm	DOC mm	FR mm/rev	Rmax (µm)	Ra (µm)	Flank wear (µm)	Crater Wear (µm)
1	115	0.8	0.08	5.07	0.717	129.53	371.68
2	115	1.5	0.2	12.68	3.382	157.66	2348.36
3	495	0.8	0.2	8.84	1.116	140.79	1041.84
4	495	1.5	0.08	5.88	0.795	84.47	1576.84

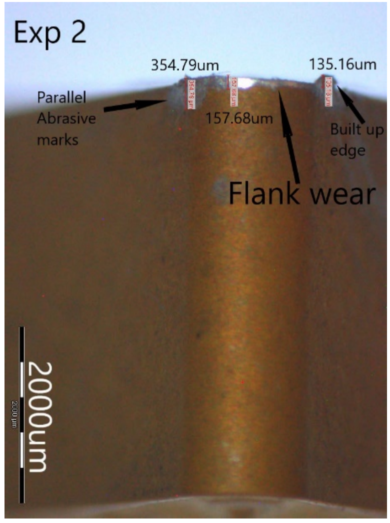
The first experiment is a combination of parameters all set at the first level, and very little tool wear is observed in this setting (Figs 2a and 3a). The workpiece material seems to adhere more to the nose radius. This adhesion caused tool wear by creating a built-up edge on the tool nose radius. Therefore, wear on the nose is also considered under the flank portion. Thin and lengthy spiral chips were formed, which are relatively easy to compact (Fig 4a).

The length of these chips is indicative of the low machining parameters. Corresponding to the second experiment, the values of both flank and crater wear increased as the machining was at a high depth of cut and feed rate (Figs 2b and 3b). Aluminum machining at this parameter setting increased cutting temperature and deteriorated surface finish of work material with an increase in tool wear. The chips formed using parameters set out for the second experiment are indicative of the lower level cutting speed and elevated depth of cut and feed rate (Fig. 4b). They are thick, lengthy, and difficult to compact. This presents safety issues since they can get caught in the rotation due to break-off difficulties.

The third experiment was conducted at high cutting speed, low depth of cut, and high feed rate. Aluminum machining at this parameter setting minimized surface roughness because the built-up edge formation was low, and hence surface deterioration was less. Both crater and flank wear were also reduced (Figs 2c and 3c). Chip breaking was evident in this experiment (Fig 4c). At a high depth of cut value (experiments 2 and 4), crater formation took the place of the tool, and hence the values of crater wear obtained were more. Experiment four was conducted at high cutting speed and depth of cut, and low feed rate. This has resulted in moderate surface roughness and high crater wear (Fig 3d). The value of flank wear was low (Fig. 2d). Due to the elevated depth of cut, the chips are thick and tend to form short spiral pieces (Fig. 4d). High cutting speed allows short chips and promotes chip break-off to form the short chips.

The findings from the set 1 experiment provided an idea for possible ranges of machining parameters for set 2 experiments to be varied for further experiments to investigate their detailed effects.





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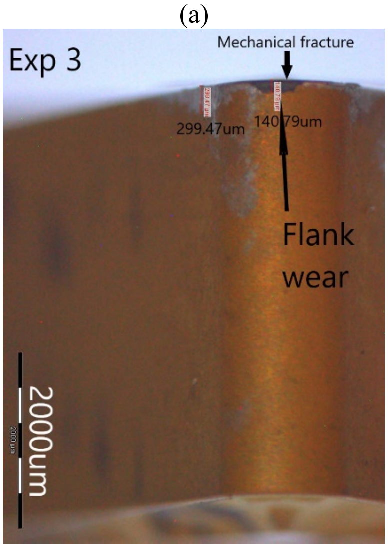


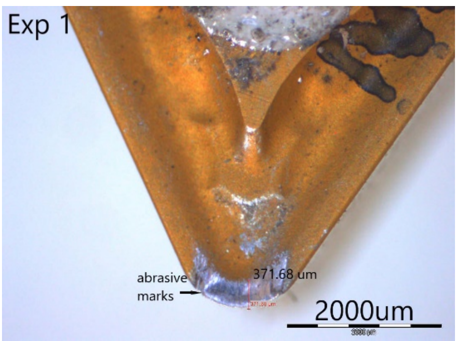
(b) (d)

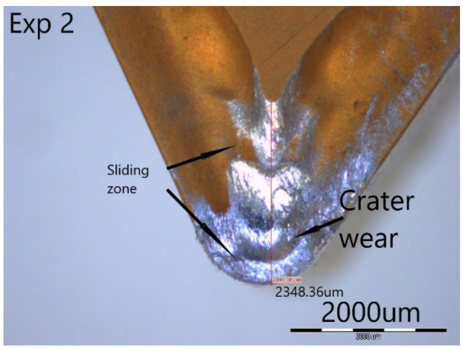
Figure 2. Flank wear on tool inserts during set 1 experiments

Table 2 presents the results of set 2 experiments. All nine experimental combinations and corresponding values of surface roughness and tool wear are given.

For Rmax, it was found that FR was the most dominant parameter, as evident from Table 3. This was assessed in the main effects plot for means using the smaller is a better configuration, as shown in Fig. 5. FR is seen to increase its effect on Rmax as it is increased. DOC, which is ranked second in influence on Rmax, is seen to decrease between the first and second input levels and increase rapidly towards the level of input. The R_{max} component of the machined surface roughness is positively affected by the increase in cutting speed.

Almost similar trends are shown in Fig. 6 for Ra. It is evident from Table 4 that FR is ranked as the most influential factor for Ra as well. Both of these responses are components of surface roughness for the machined surface. Therefore, It is concluded that FR be noted as the most influential input parameter for aluminum machining on the center lathe. Figure 7 presents the main effects plots for flank wear versus CS, DOC, FR, and MT.





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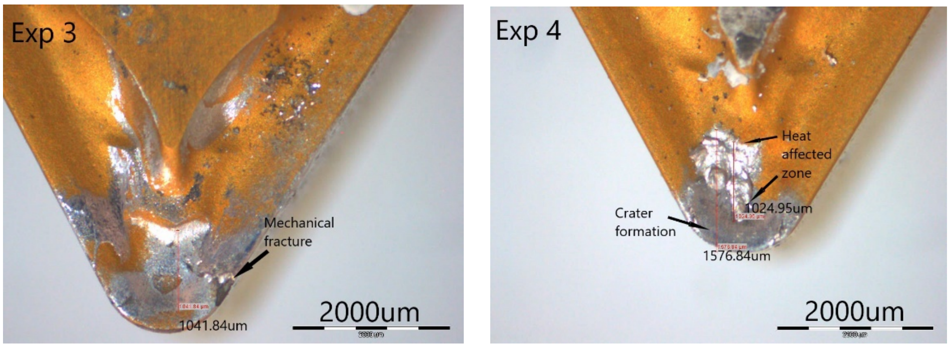

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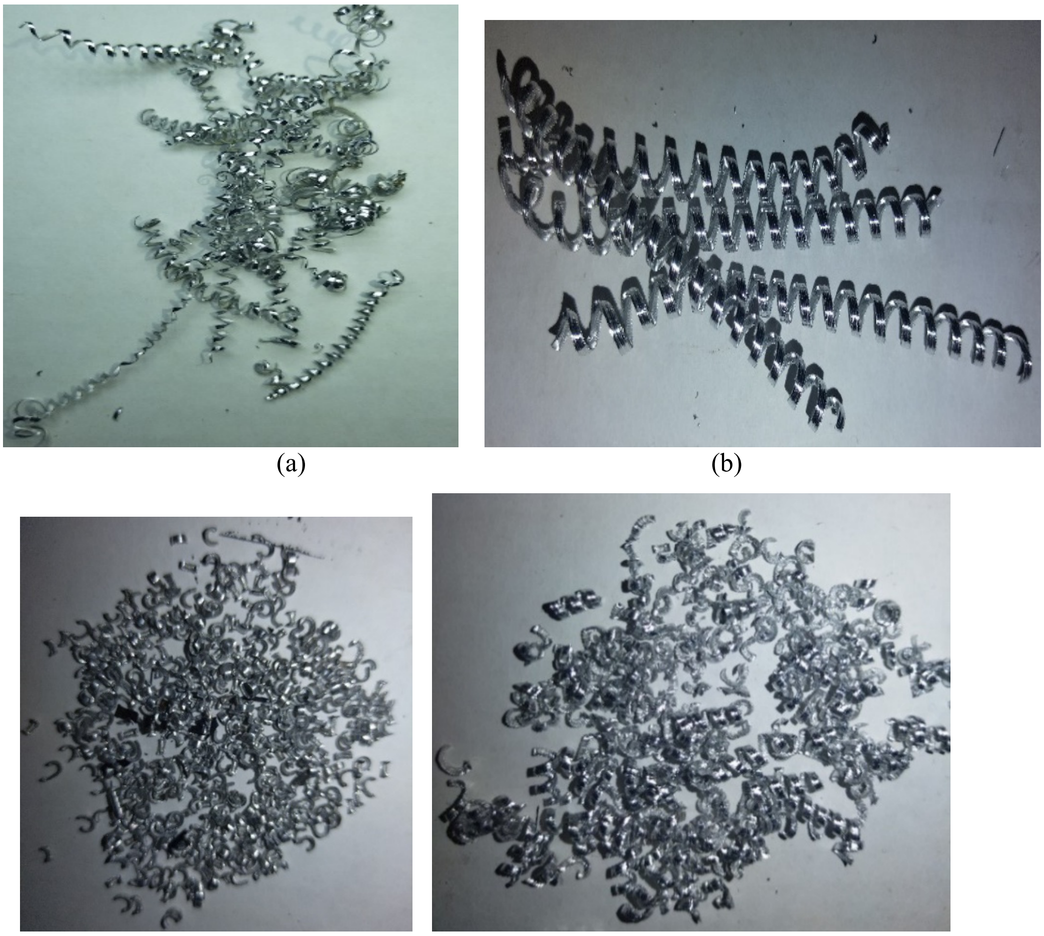
Figure 3. Crater wear on tool inserts during set 1 experiments



(a) (b)

(c) (d)

Figure 4. Chips generated during set 1 experiments

Table 2. Set 2 experiments results for the dry machining of Aluminum 7075

	Input parameters			Output parameters			
	CS rpm	DOC mm	FR mm/rev	Rmax (µm)	Ra (µm)	Flank wear (µm)	Crater Wear (µm)
1	115	0.8	0.12	5.34	0.694	129.53	1700.73
2	115	1.0	0.15	5.8	0.763	112.63	2348.36
3	115	1.2	0.2	9.73	1.071	112.63	2354.00
4	207	0.8	0.15	6.44	0.780	118.26	2263.89
5	207	1.0	0.2	8.74	0.827	129.53	2241.36
6	207	1.2	0.12	5.27	0.716	140.79	2213.21
7	495	0.8	0.2	7.33	1.03	123.89	2207.58
8	495	1.0	0.12	5.39	0.869	146.42	2185.05
9	495	1.2	0.15	6.44	0.852	230.89	2196.31

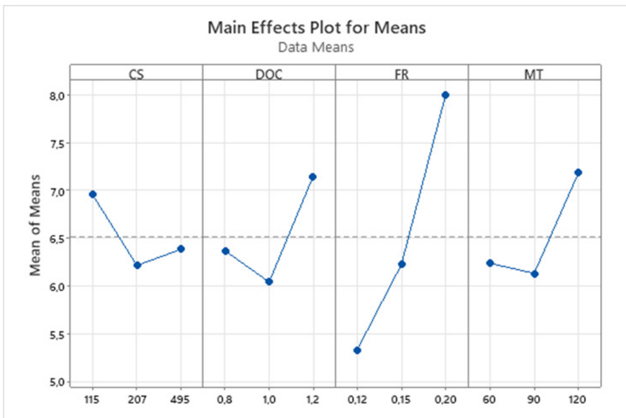


Figure 5. Main Effects Plots for Rmax vs CS, DOC, FR, MT

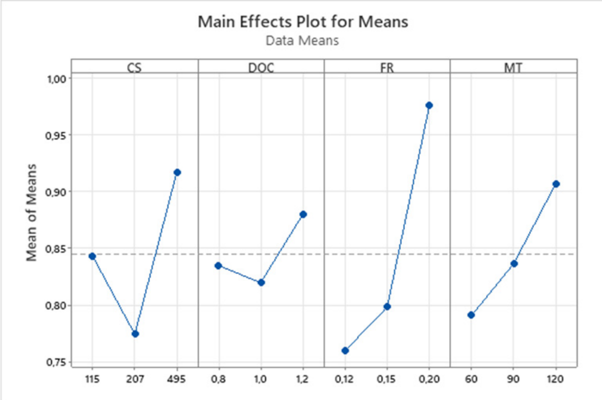


Figure 6. Main Effects Plots for Ra vs CS, DOC, FR, MT

Table 1: Parameter influence on R_{max}

Level	CS	DOC	FR	MT
1	6.957	6.370	5.333	6.240
2	6.217	6.043	6.227	6.133
3	6.387	7.147	8.0	7.187
Delta	0.740	1.103	2.667	1.053
Rank	4	2	1	3

Table 4: Parameter Influence on R_a

Level	CS	DOC	FR	MT
1	0.8427	0.8347	0.7597	0.7910
2	0.7743	0.8197	0.7983	0.8363
3	0.9170	0.8797	0.9760	0.9067
Delta	0.1427	0.600	0.2163	0.1157
Rank	2	4	1	3

Figure 8 (a-f) and Figure 9 (a-c) present the tool flank wear images for the set 2 experiments. In the tool wear study, there is a very noticeable effect when the DOC is the highest. As presented in Figure 8 (c, f) and Figure 9 (c), there is greater abrasive wear on the flank face of the cutting tool. The extent to which the tool wear on the surface of the cutting tool propagated is indicative of the effect of the chips on the sliding zone. Because the chips are lengthier and thicker due to the DOC, they extended the sliding zone inward and promoted crater wear on the surface. The tool wear on the nose radius is relatively lower. There is abrasion on the nose radius of the cutting tool, as seen in Figure 8 (c). The prolonged machining time allowed for the heat generated at the cutting zone to affect the material adhesion as it allowed prolonged heat transfer between the two materials in contact, and that led to severe tool wear, as evident.

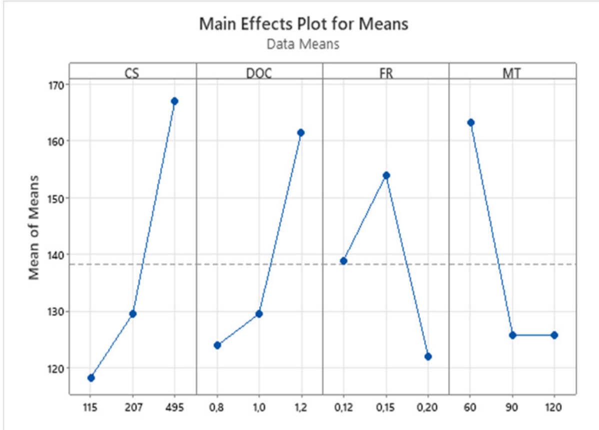


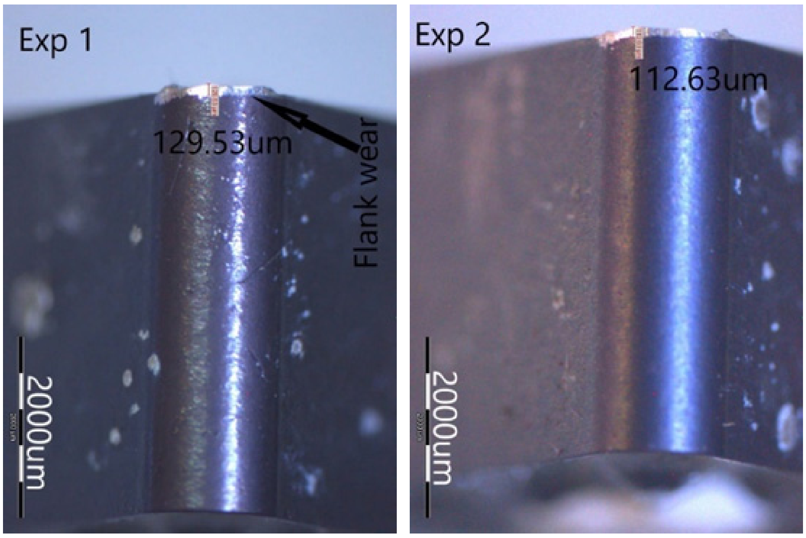
figure 7. Main effect plots for flank wear vs CS, DOC, FR, MT

The prolonged machining time has significant effect on the amount of wear that a cutting tool is subjected to. Figure 9 (c) is achieved when the machining time is the lowest, and all other input parameters are at their highest. A flank wear of 230.89 µm is achieved with the parameter setup. The effect of DOC is evident on the wear on the flank face of the cutting tool.

The cutting speed (CS) is found as the most influential parameter on the flank wear of the cutting tool when considering the smaller-the-better type signal-to-noise ratio (Table 5). CS is followed by machining time (MT), then DOC, with FR being the least influential parameter.

Table 5: Parameter influence on flank wear

Level	CS	DOC	FR	MT
1	118.3	123.9	138.9	163.3
2	129.5	129.5	153.9	125.8
3	167.1	161.4	122.0	125.8
Delta	48.8	37.5	31.9	37.5
Rank	1	3	4	2



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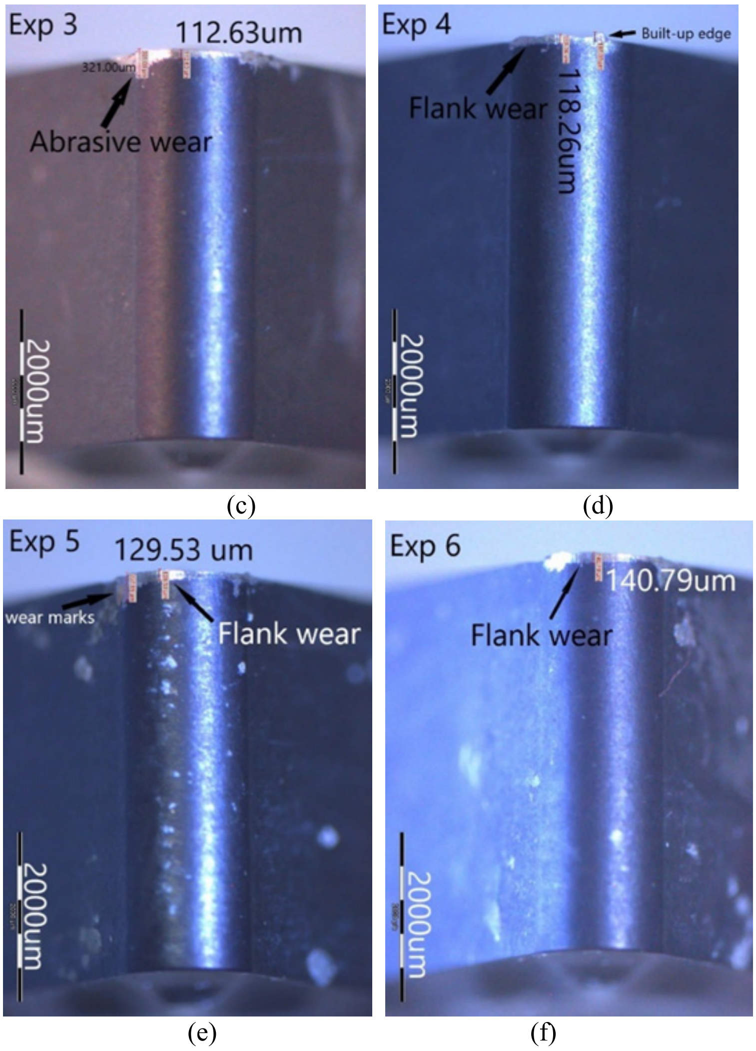


Figure 8. Flank wear on tool inserts during set 2 experiments 1 to 6

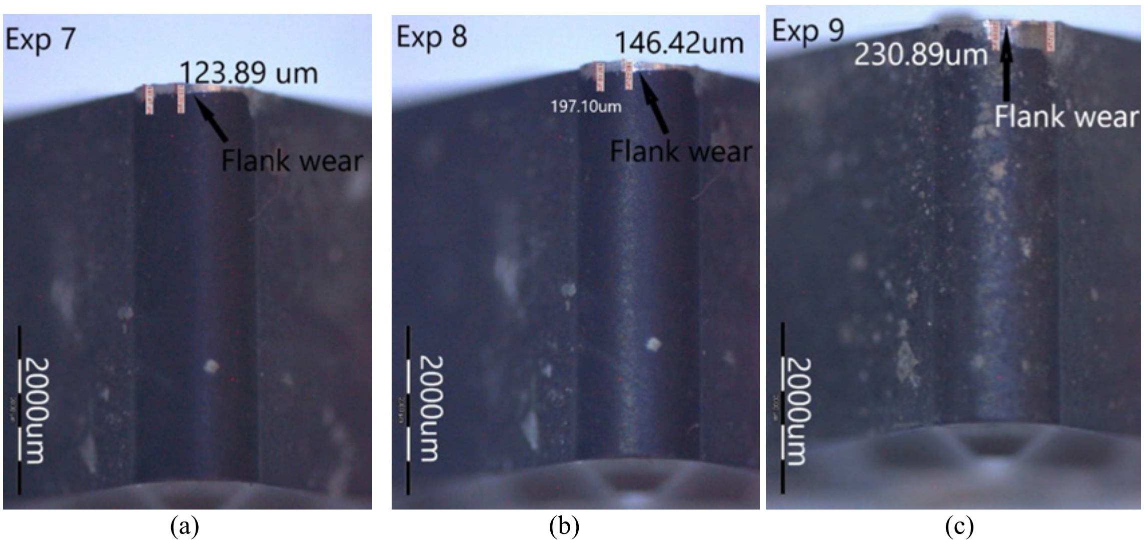
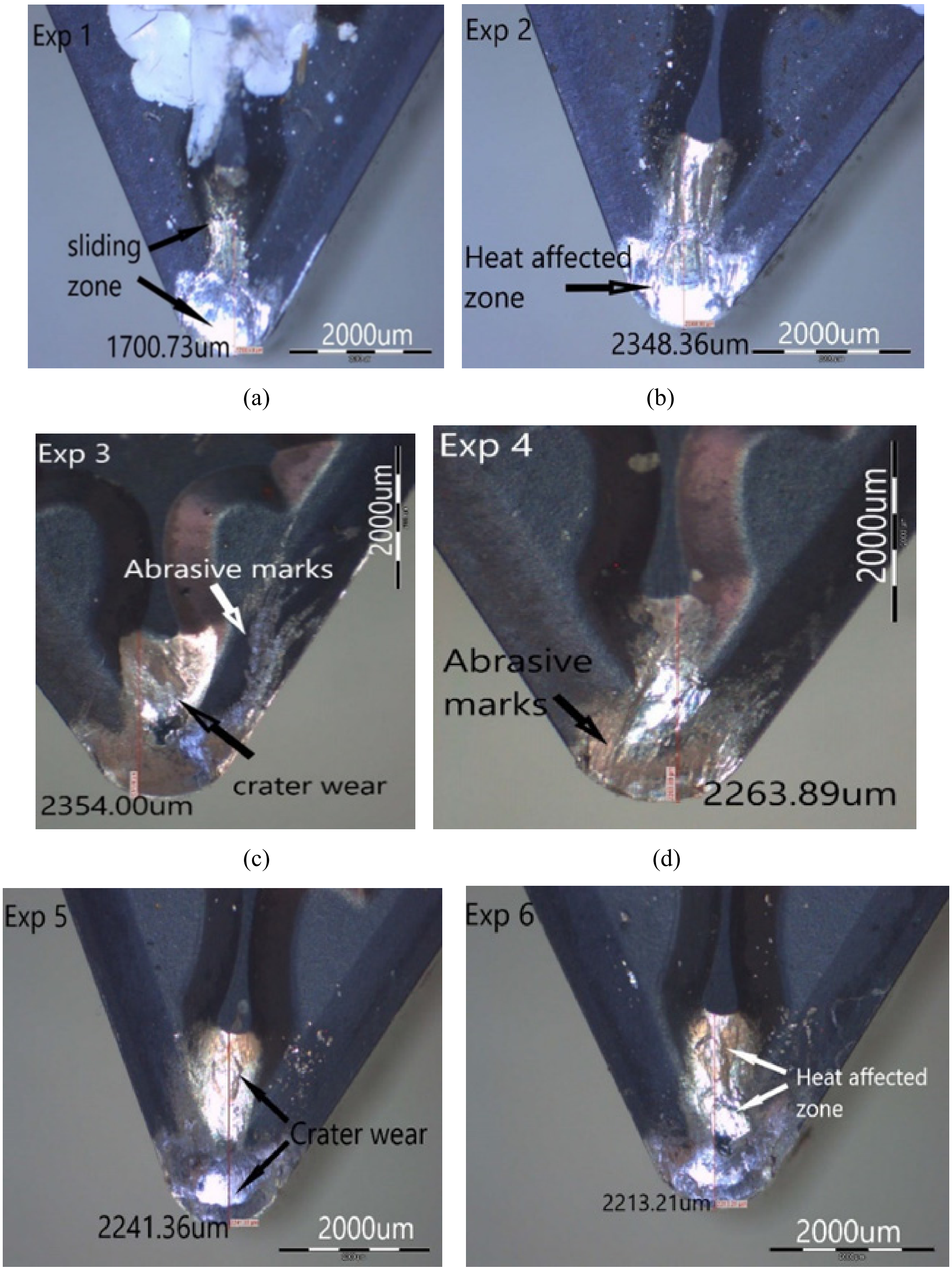


Figure 9. Flank wear on tool inserts during set 2 experiments 7 to 9

An increase in input parameters DOC, FR, and MT resulted in an increase in tool wear. The CS is kept at the lowest for experiment 2, and all other parameters are increased to the next level. The effect of the increased parameters resulted in an increase in the sliding zone, and as such more craters are evident on the tool surface. Figure 10 (a-f) and Figure 11 (a-c) illustrate the crater wear obtained while conducting set 2 experiments. Figure 10 (b-f) and Figure 11 (a-c) appear to have a larger sliding zone. There is a little bit of the workpiece material attached to the tool surface. This is indicative of the material adherence to the cutting tool. The heat generated at the cutting zone promoted the adhesion with the formation of a built-up edge.

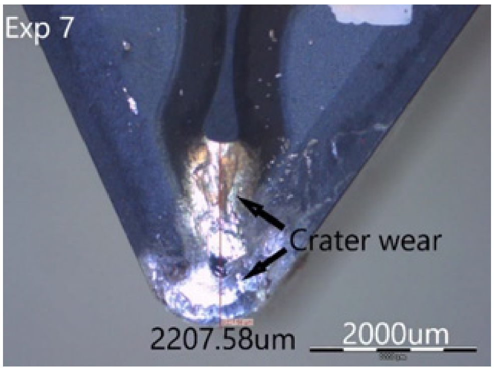
Experiments 6 to 9 yielded similar results pertaining to adhesive wear. There is material adhesion on the cutting surface of the tool. There is a crest-like structure formed on the sliding zone. The high level of CS pro–moted heat generation and thus melted the work material, which then adhered to the surface of the tool. There is a heat-affected zone visible on the tool rake face, as shown in Figure 10 (f) and Figure 11 (a-c), where some of the melted material is visible. The craters formed due to erosion on the sliding zone at the start of machining allowed for more adhesion as the material clots the eroded section. There is notable flank wear which can be attributed to the chip movement during cutting action.

As per Table 2, the first experiment was carried out with the lowest level of parameters. The tool wear on the nose radius of the cutting tool is the lowest. This is acceptable since all the performance parameters are low. The FR and DOC have minimal impact on the machining performance. There is, however, notable wear on the surface of the tool. This is due to the temperature changes during cutting caused by friction between the cutting tool, work material and chips. Craters are formed by the chips eroding the surface as they are being removed from the work material by the cutting action forming sliding zones on the cutting tool surface.



(e) (f)

Figure 10. Crater wear on tool inserts during set 2 experiments 1 to 6



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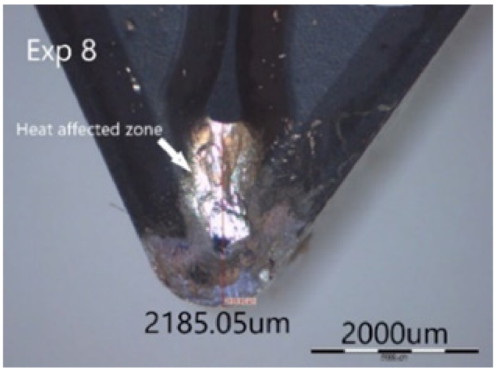

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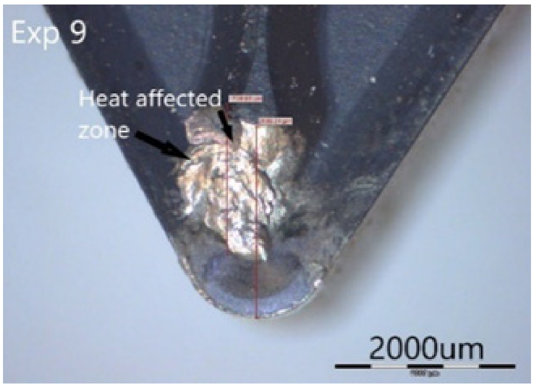

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Figure 11. Crater wear on tool inserts during set 2 experiments 7 to 9

4. CONCLUSIONS

This article has reported the results and discussed the outcomes of an investigation conducted on the dry machining of aluminum 7075 using plain carbide tools. The following are the major conclusions:

•The minimum value of surface roughness obtained at CS- 207 RPM, DOC- 1.2 mm, FR- 0,12 mm/rev, MT- 90 sec, and minimum tool flank wear obtained at CS- 115 RPM, DOC- 1 mm, FR- 0.15 mm/rev, MT- 90 sec.

•The cutting speed up to 495 RPM is suitable to carry out the machining of aluminum, as the tool wear is under limit. Higher cutting speed tends to better productivity of the machining process.

•A high depth of cut subjects the machining process to cutting forces that have detrimental effects on the machinability of the work material and therefore have to be avoided.

•Feed rate is the most influential factor in the machined surface roughness, where a directly proportional relationship was observed. A low feed rate is suitable for better machinability.

•A prolonged machining time is crucial and should be kept below 90 seconds when machining aluminum using plain carbide tools for better results.

•An optimum set of parameters for better machinability of aluminum is cutting speed- 115 RPM, depth of cut- 0.8 mm, feed rate- 0.12 mm/rev, and machining time- 90 seconds.

•The outcomes and findings of this research are useful for the sustainable machining of aluminum to manufacture quality parts for automotive, defense, and aerospace applications.

•Further investigations may be done at high cutting speed and using different machining strategies such as textured tools, minimum quantity lubrication, solid lubricants, etc. A comparative study between plain carbide tool-based machining of aluminum and machining with other interventions, such as treated and textured-based machining, use of solid lubricant, and assisted hybrid machining, can also be conducted as important future research avenues.

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REFERENCES

[1] Knight, W.A., Boothroyd, G. Fundamentals of Metal Machining and Machine Tools. Boca Raton: CRC Press, 2005.

[2] Leksycki, K., Feldshtein, E., Ociepa, M.: On The Effect Of The Side Flow Of 316l Stainless Steel In The Finish Turning Process Under Dry Conditions', Facta Universitatis, Series: Mechanical Engineering (FU Mech Eng) Vol. 19, No. 2, pp. 335-343, 2021.

[3] Karolczak, P.: Application of Discrete Wavelet Transform to Analysis of Cutting Forces in Turning of Composites based on Aluminium Alloys Reinforced with Al2O3 Fibres, FME Transactions Vol. 50, p. 623-634, 2022.

[4] Ahmed, L.S., Yuvaraj, N., Hariprasad, T: Influence of Cryogenic Reaming Process Parameters on Titanium Alloy by Using Grey Relational Analysis, FME Transactions Vol. 47, p. 634-640, 2019.

[5] Santos, J.R., Mario, C.: Machining of aluminum alloys: a review. Springer-Verlag London, pp. 3067-3080, 2016.

[6] Abas, M., Sayd, L., Akhtar, R., Khalid, Q.S., Khan, A.M., Pruncu, C.L.: Optimization of machining parameters of aluminum alloy 6026-T9 under MQL-assisted turning process, Journal of Materials Research and Technology, Vol. 9, No. 5, pp. 10916-10940, 2020.

[7] Abou-El-Hossein, K., Olufayo, O.A.: Diamond Machining of Rapidly Solidified Aluminum for Optical Mould Inserts, Procedia Materials Science, Vol. 6, pp. 1077 – 1082, 2014.

[8] Çakır, A., Yağmur, S., Kavak, N.: The effect of minimum quantity lubrication under different parameters in the turning of AA7075 and AA2024 aluminum alloys, Int J Adv Manuf Technol, Vol. 84, pp. 2515–2521, 2016.

[9] Pattnaik, S.K., Bhoi, N.K., Padhi, S.: Dry machining of aluminum for proper selection of cutting tool: tool performance and tool wear, Int J Adv Manuf Technol, Vol. 98, pp. 55–65, 2018.

[10] Ariff, T. F., Sofian, N. N., Che Mat, N. H.: Dry Machining of T6061 Aluminum Alloy Using Titanium Carbonitride (TiCN) Coated Tools, Advanced Materials Research, Vol. 652–654, pp. 2129–2133, 2013.

[11] Roy, R.S., Dash, S., Mahapatra, T.R., Mishra, D., Jaypuria, S.: Cutting Performance Analysis of Surface Textured Tools in Dry Turning: Optimisation of process parameters, E3S Web Conf., Vol. 309 pp. 01164, 2021.

[12] Patel, M. G., Lokare, D., Chate, G. R., Par, M. B.: Analysis and optimization of surface quality while machining high strength aluminum alloy, Measurement, Vol. 152, pp. 107337-107353, 2020.

[13] Saravanakumar, A. et al.: Optimization of CNC Turning Parameters on Aluminum Alloy 6063 using Taguchi Robust Design, Materials Today: Proceedings, Vol. 5, No. 2, pp. 8290-8298, 2018.

[14] Qazi, M.I., Abas, M., Khan, R., Saleem, W., Pruncu, C.I., Omair, M.: Experimental Investigation and Multi-Response Optimization of Machinability of AA5005H34 Using Composite Desirability Coupled with PCA, Metals, Vol. 11, No. 2, pp. 235, 2021.

ИСТРАЖИВАЊЕ О ОБРАДИВОСТИ АЛУМИНИЈУМА 7075 У СУВОМ ОКРУЖЕЊУ

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Алуминијум је лаган и мекан материјал који се тешко обрађује. То је најпроизводнији обојени метал и подвргнут је опсежној машинској обради за развој широког спектра производа. Напредак у индустрији инспирише потребу да се пронађу одрживи начини за обраду алуминијума и његових легура коришћењем конвенционалних процеса обраде. У студији објављеној у овом раду, спроведена су два скупа експеримената за испитивање обрадивости алуминијума 7075 коришћењем обичног карбидног алата у сувом окружењу, тј. без подмазивања. У првом сету су спроведена четири груба експеримента где су три важна параметра обраде, односно брзина резања БР (115-495 о/мин), дубина реза ДР (0,8-1,5 мм) и брзина помака БП (0,08-0,2 мм/обр.).) су варирани на два нивоа да би се проверило понашање одзива или индикатора обрадивости, тј. храпавост површине и хабање алата, на највишим и најнижим вредностима параметара обраде. На основу резултата првог скупа експеримената, опсези и нивои параметара су фиксирани у другом сету за детаљну студију обрадивости алуминијума. Изведено је укупно девет експеримената заснованих на Тагучијевом робусном дизајну технике експеримента са ортогоналним низом Л9 где је уведен додатни параметар обраде, односно време обраде ВО. Детаљно је проучаван утицај параметара обраде на хабање алата и храпавост површине и утврђено је да је сува обрада алуминијума могућа без раног квара алата. Сува обрада са ниским вредностима БР, ДР, БП и средњег ВО је пожељна за бољу обрадивост, односно минималну храпавост и хабање алата, оптималну комбинацију параметара обраде брзина резања- 115 РПМ, дубина реза- 0,8 мм, брзина помака - 0,12 мм/обр., а време обраде - 90 секунди. Налази овог рада ће помоћи инже–њерима и истраживачима у постизању квалитета, продуктивности и одрживости, док ће производити делове и компоненте од алуминијума који ће се користити у аутомобилском, одбрамбеном и ваздухопловном сектору.