International Journal of Recent Technology and Engineering (IJRTE)
ISSN: 2277-3878, Volume-8 Issue-5, January 2020

Experimentation on Mechanical Properties and Machinability of Al7075/Al_2o_3/Gr/Sic Metal Matrix Component

Gourav Tiwari, P. Satya Dharma Teja

Abstract: Aluminum based metal matrix composite was prepared by stir casting process. Generally metal matrix composites are having some benefits due to the present's reinforcement particles. Basically aluminum material does not have much strength, for increasing its strength and mechanical properties reinforcement particles are like SiC, Boron Carbide, Aluminum Oxide, Titanium Carbide, Fly Ash, Graphite added to base material. In this experiment 2.5% of Al_2O_3, 5% of Graphite and 5% of Silicon Carbide are added toAl7075 (base material). The Microstructure of composite has been identified under optical microscope. Impact, Hardness, Tensile tests were conducted to find out the strength of the metal matrix composite. To find out the surface finish of composites after machining Taguchi method was adopted for the design of experiments and L9 Orthogonal array was taken to identify the optimum machining parameters affecting surface finish. In adding of 2.5% of Al_2O_3, 5% of Gr and 5% of SiC the Impact Strength of Izod test is decreased by 23%, 30%, 46% and the Impact Strength of Charpy test is increased by 20%,-20%, and 20% respectively. The Brinell hardness value and Rockwell Hardness is increased by 9%, 3%, 28% and 9%, 1%, 6% respectively compare to the base material Al7075.Tensile Strength is decreased by 17%, 12%, 50% by adding of 2.5% of Al_2O_3, 5% of Gr and 5% of SiC respectively compare to base alloy. The better surface finish is obtained at speed 1500 rpm, feed 0.05 mm/rev and 1 mm depth of cut for the materials Al7075.The lowest Tool Wear occurred for the material Al7075 at1000 rpm, feed at 0.05 mm/rev and depth of cut at 0.25.

***Key words: metal matrix, reinforcement,* Taguchi, *orthogonal* array.**

I. INTRODUCTION

Now a day's material science engineering is playing an important role in all industries. Composite Martials are replacing the conventional engineering materials. Composite materials are showing better materials properties than the other materials. By adding of the reinforcement particles to the base alloy, it will increase the strength of composite material. Mostly these composite materials are used in automobile, aerospace industries. The present scenario is concentrating on the light weight, high strength and good mechanical properties of the materials. Based on research Al7075 materials are showing superior quality than the other aluminum alloy materials. In the composite material mostly used reinforcement particle are like al_2o_3, Graphite, tic, boron carbide, Silicon Carbide.

Revised Manuscript Received on January 15, 2020.

Mr. Gourav Tiwari, Assistant Professor, VNR Vignana jyothi of Engineering and Technology, Hyderabad, India.

Mr. P. Satya Dharma Teja, Pursuing M.TECH (AMS), VNR Vignana jyothi of Engineering and Technology, Hyderabad, India.

The main aim of the study is to fabricate the metal matrix composite by taking Al7075 as base material and using three different reinforcement particle are al_2o_3, Graphite and sic and analyzing the mechanical properties by using taguchi technique and strength of the composite. Based on research stir casting is easy and low cost technique to fabricate the metal matrix composite material.

II. EXPERIMENTATION SETUP

Metal matrix composite is fabricated using stir casting technique.Al7075 taken as base material and2.5% of Al_2O_3, 5% of Graphite (Gr) and 5% of Silicon Carbide (SiC) reinforcement particles added one after another to the base material in step by step process. All reinforcement particles are preheated before adding into furnace. The composite matrix is mixed using the stirrer 120rpm speed in furnace at 800ºC temperature. The molten matrix is poured in to die model specimens as per ASTM standards.

Table- I: Chemical composition of the AL7075material

Chemical composition of the materi	Si	Fe	Cu	Mg	Mn	Cr	Zn	Ti	Al
Al7075	0.4	0.5	1.6	2.5	0.3	0.15	5.5	0.2	Remaining

For conducting the experiments we need different types of specimens. For each specimens are having different specification. The tests and specification are discussed in below.

A. Microstructure

The Microstructure is used study the bonding of the reinforcement particles with the base alloy and also analyze the quality of metal matrix composite. The grain structures of different composition of specimens are observed in the optical microscope. Quantification of the Microstructure is one of the factors, which reveal the behavior of these materials. We can observe the distribution, gaps and porosity of the particles in metal matrix composite.

B. Impact Strength

For the Impact Strength, Izod test was conducted on desire notched specimens as per ASTM standards. Each specimen having dimensions of 75×10×10 mm· the specimens are mounted in vertical direction and the hitting angle of Izod test is 90º.Three specimens of each composition type were tested in according with same standards. For the Impact Strength, Charpy test was conducted on desire notched specimens as per ASTM standards. In the Charpy test the dimension of specimens are different from the Izod test. Each specimen having dimensions of 55×10×10 mm and it mounted in horizontal direction. The hitting angle of Charpy test is 140º. Three specimens of each composition type were tested in according with same standards.

C. Hardness

The hardness test was conducted on desire Specimens as per ASTM standards. The test was conducted according to the procedure. There are different types of hardness are available. As per our requirement we can choose any of them. In this research I have taken Brinell hardness and Rockwell Hardness. These hardness testing machines are depending on the diameter of intender and load applying on the specimens. The hardness value is measured on the each sample at different places of specimen to obtain an average value of hardness.

D. Tensile

Tensile test was conducted on the desire specimens as per B557:16 ASTM standards. The Tensile strength was calculated on the cylindrical specimen rod of casted composites. The Tensile specimens having dimensions of 200 mm in gauge length and 12 mm diameter, respectively. Strength can be calculated by engage the specimen in a direction parallel to the applied load and maximum applied load on the specimen is 200 KN.

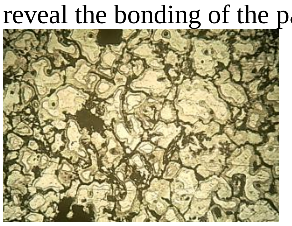
E. Machinability test

Machinability test is the removal of material from the work piece when it is subjected to cutting operation to get good surface finish with low cost. Good surface finish is depends on Tool Wear and Surface Roughness. Three parameters are considered to get better finish. They are speed, feed, and depth of cut. Different tool tips and these parameters are used for the machining of different specimens. Peaks and valley of the specimens can be measured using Surface Roughness tester. The taguchi analysis is used to optimizing the machinability parameters.

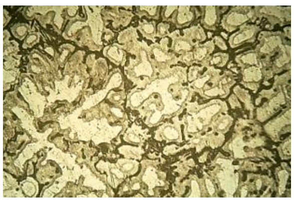
III. RESULTS AND DISCUSSION

A. Microstructure

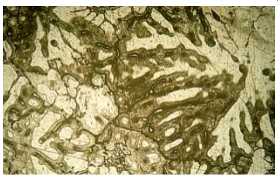
Microstructures the Microstructure of the specimens is observed in the optical microscope. Below picture will reveal the bonding of the particles.



(a)



(b)



(c)

Fig.1. Microstructure of specimens (a) Al7075+2.5 % Al_2O_3 (b) Al7075+ 2.5%Al_2O_3+ 5%Gr (c) Al7075+ 2.5%Al_2O_3+ 5%Gr + 5% SiC.

The void gaps formed due to casting defect. Grains are randomly oriented. The above pictures (a,b,c) we can observe bigger particles are formed due to the more aluminum particles are present in the matrix and smaller black sports are clearly depicting reinforcement particles. All three aluminum oxide, Graphite and Silicon Carbide reinforcement particles reasonably non-uniformly distributed. Some impurities are formed because of the Graphite reinforcement particles are floated in the matrix due to the low density. Porosity was observed adjacent to the reinforcement particles.

B. Impact Strength

Impact Strength was calculated based on the position of work piece and hitting angle of the hammer. In the 1^{st} Izod test, the work piece mounted vertically and hitting angle is 90º. Three readings are taken for each composition of the specimens.

1. Izod

Table- I: Izod test results of each composition

s. no	Readings of Impact Strength J/mm^2	Impact Strength J/mm^2 (Izod)	Toughness J/mm^3	Average of Impact Strength	Average of Toughness
	Al7075				
1	9 10 10	0.1125 0.125 0.125	0.0045 0.0034 0.0022	0.13	0.0035
	Al7075+2.5 % Al_2O_3				
2	8 10 6	0.1 0.125 0.075	0.0045 0.0056 0.0034	0.1	0.0045
	Al7075+ 2.5%Al_2O_3+ 5%Gr				
4	8 9 5	0.1 0.1125 0.0625	0.0045 0.0051 0.0028	0.09	0.0041
	Al7075+ 2.5%Al_2O_3+ 5%Gr + 5% SiC				
4	8 6 4	0.1 0.075 0.05	0.0045 0.0034 0.0022	0.07	0.0033

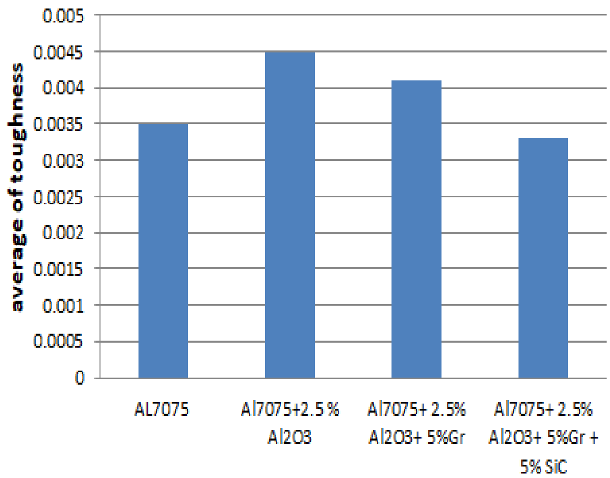


Fig.2.Average of Toughness (Izod)

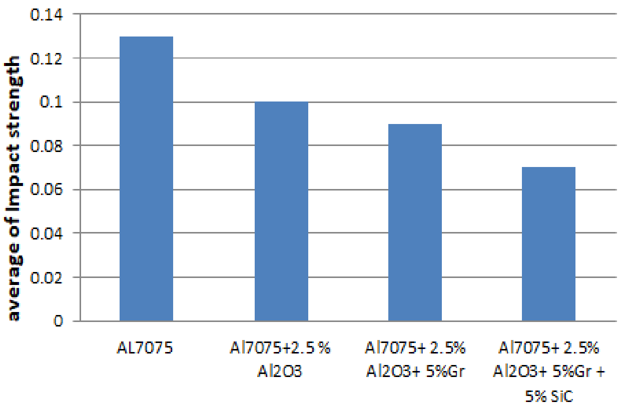


Fig.3.Average of Impact Strength (Izod)

From the Fig.2 we can observe that Al7075+2.5 % Al_2O_3 specimen has higher Toughness value compare to the other specimens. Same as in Fig.3 base material Al7075 showing higher Impact Strength value than the other metal matrix composite specimens. In Fig.2&3 Al7075+ 2.5%Al_2O_3+ 5%Grspecimen is having close value to the Al7075+2.5 % Al_2O_3specimen.

2. Charpy

Impact Strength was calculated based on the position of work piece and hitting angle of the hammer. In the 2nd Charpy test, the work piece mounted horizontally and hitting angle is 140°. Three readings are taken for each composition of the specimens

Table-II: Charpy test results of each composition

S. No	Readings of Impact Strength J/mm²	Impact Strength J/mm² (Charpy)	Toughness (J/mm³)	Average of Impact Strength	Average of Toughness
	Al7075				
1	5 7 7	0.1 0.14 0.14	0.0036 0.0050 0.0050	0.13	0.0030
	Al7075+2.5 % Al_2O_3				
2	5 8 8	0.1 0.16 0.16	0.0036 0.0058 0.0058	0.14	0.0050
	Al7075+ 2.5%Al_2O_3+ 5%Gr				
3	4 7 7	0.08 0.14 0.14	0.0029 0.0050 0.0050	0.12	0.0043
	Al7075+ 2.5%Al_2O_3+ 5%Gr + 5% SiC				
4	8 6 8	0.16 0.12 0.16	0.0058 0.0043 0.0058	0.14	0.0053

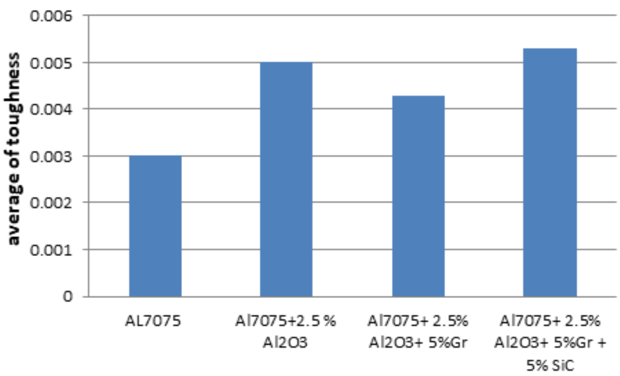


Fig.4.Average of Toughness (Charpy)

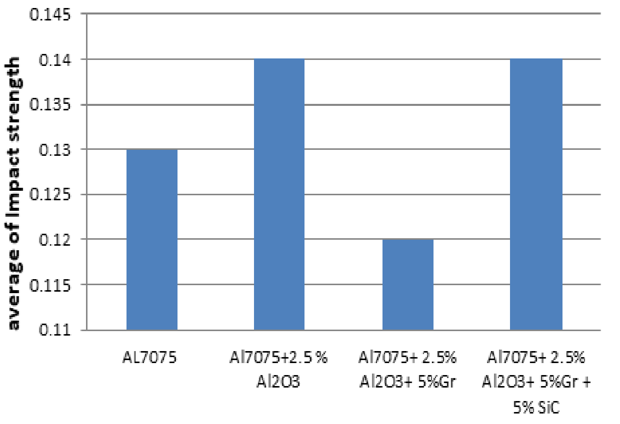


Fig.5.Average of Impact Strength (Charpy)

From the Fig.4 we can observe that Al7075+ 2.5%Al_2O_3+ 5%Gr + 5% SiC specimen has higher Toughness value compare to the other specimens. But Al7075+ 2.5%of specimen is having very close value to Silicon Carbide added specimen. Al7075+ 2.5%and Al7075+ 2.5%Al_2O_3+ 5%Gr + 5% SiC specimens are having same Impact Strength value.

C. Hardness

For this experiment two types of hardness test are conducted as shown in table II and III.

1. Brinell Hardness

In this test three reading are taken for each composition of the specimens. 250 Load applied on each specimen under the 5 mm intender diameter. Finally average value is taken for each composition of the materials.

Table-II: Brinell hardness test results of each composition

S.no	Materials	Load (5.0/ 250)	Samples of Brinel Hardness (BHN)	Average of Brinell Hardness
1	Al7075		100 103 102	101.6
2	Al7075+2.5 % Al_2O_3		108 110 111	109.3
3	Al7075+ 2.5%Al_2O_3+ 5%Gr		96 99 98	97.66
4	Al7075+ 2.5%Al_2O_3+ 5%Gr + 5% SiC		127 130 127	128

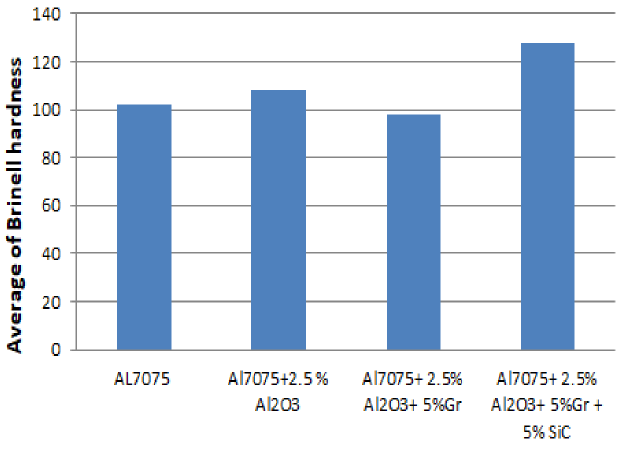


Fig.6.Average of Brinell hardness

In Brinell hardness test, the Al7075+ 2.5%Al_2O_3+ 5%Gr + 5% SiC specimen is showing higher value in Fig. 6 compare to the other composite specimens because of the Silicon Carbide particles.

D. Rockwell Hardness

In this test three reading are taken for each composition of the specimens. 100 Load applied on each specimen under the 1/16 mm intender diameter of steel bar.

Table-III: Rockwell Hardness test results of each composition

S.no	Materials		Samples of Rockwell Hardness(HRB)	Average of Rockwell Hardness
1	Al7075		60 65 55	60
2	Al7075+2.5 % Al_2O_3		67.4 68.1 68.8	68.1
3	Al7075+ 2.5%Al_2O_3+ 5%Gr	Load (100 1/16)	61.5 60.2 59.6	60.4
4	Al7075+ 2.5%Al_2O_3+ 5%Gr + 5% SiC		64.9 65.2 64.0	64.7

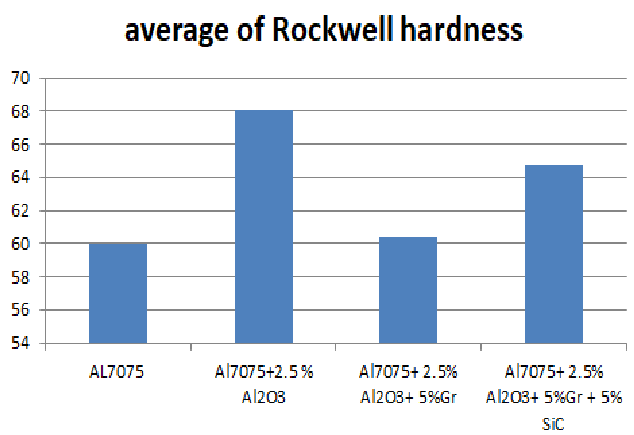


Fig.7.Average of Rockwell Hardness

In Rockwell Hardness test, Al7075+2.5%Al_2O_3 composite specimen is showing higher value in in Figure number 7 compare to other composite specimens.

E. Tensile Test

In this test two reading are taken for the each composition of the specimens. 200KN applied on the each specimen.

Table- IV Tensile test results of each composition

S. n	Compo sition	Tensile Strength (N/mm^2)	Average of Tensile Strength	Elongation at peak (mm)	Average of Elongation at peak	Yield Stress (N/mm^2)	Average of Yield Stress (N/mm^2)
1	Al7075	240 200	220	6.9 7.3	7.1	180.36 223.15	201.75
2	Al7075 +2.5 % Al_2O_3	165.89 195.32	180. 605	5.3 4.2	4.75	154.56 112.68	133.62
3	Al7075 + 2.5%Al_2O_3+ 5%Gr	202.41 181.16	191. 785	7.2 5.9	6.55	200.63 164.23	182.64
4	Al7075 + 2.5%Al_2O_3+ 5%Gr + 5% SiC	139.52 3 77.76	108. 63	3.4 1.8	2.6	1 28.12 78.67	103.39

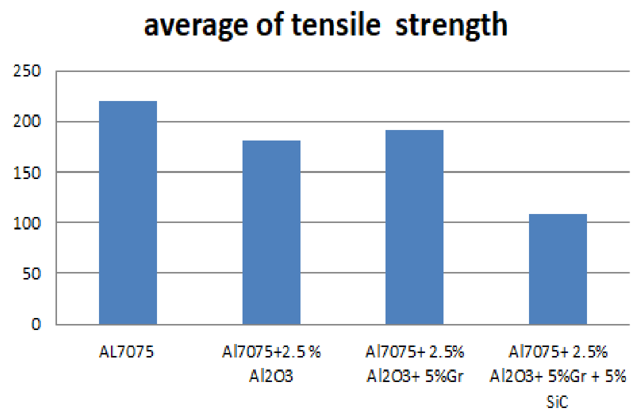


Fig.8.Average of Tensile strength

Base alloy material showing higher value compare to the other composite materials. The Graphite composite material is showing higher value at Yield Strength Elongation at peak compare to other composite materials.

F. Machinability

Generally machinability will discuss the Surface Roughness and Tool Wear rate of the work piece. This test is depends on the three levels and four factors. They are speed, feed depth of cut and materials.

In this experiment taguchi method is used to calculate the out puts of effecting parameters and also identified the finest parameter at “small the better”(based on Surface Roughness and Tool Wear) condition. The valve of Analysis of Variance (ANOVA) and response table are calculated by using MINITAB software. In this process L9 OA is used for the design of the experiments as shown in the table V. The results of Surface Roughness and Tool Wear are calculated separately in two steps.

G. Surface Roughness

In the first step of machinability test L9 orthogonal array has taken. In this process 3 level design and 4 factors was taken. In the input level Surface Roughness taken as responsible data. The input data was analyzed so that Means and signal to noise ratio graphs were obtained as shown in below Fig.9and10

Table- V: L9 Orthogonal Array of Surface Roughness

S.No	Speed (RPM)	Feed (mm/rev)	DOC (mm)	Materials	SR (R_a)
1	1000	0.05	0.25	Al7A	1.90
2	1000	0.10	0.50	Al7G	1.60
3	1000	0.15	1	Al7S	1.09
4	1200	0.05	0.50	Al7A	2.40
5	1200	0.10	1	Al7G	0.80
6	1200	0.15	0.25	Al7S	1.03
7	1500	0.05	1	Al7A	0.90
8	1500	0.10	0.25	Al7G	1.40
9	1500	0.15	0.50	Al7S	1.18

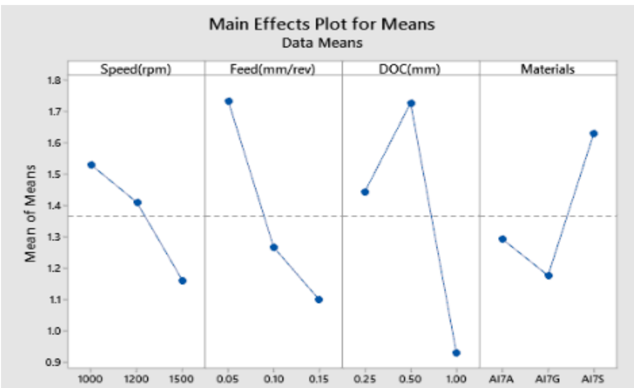


Fig.9. Effecting parameters of Means

(Surface Roughness)

Table-VI: Response table of Means (Surface Roughness)

Level	Speed(rpm)	Feed(mm/rev)	DOC(mm)	Materials
1	1.5300	1.7333	1.4433	1.2933
2	1.4100	1.2667	1.7267	1.1767
3	1.1600	1.100	**0.9300**	1.6300
Delta	0.3700	0.6333	0.7967	0.4533
Rank	4	2	1	3

The above response table VI showing optimum value 0.9300 based on effecting parameters at the smaller the condition.

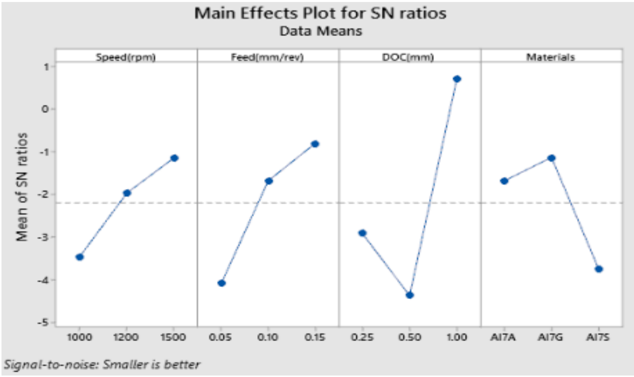


Fig.10. Effecting parameters of Signal to Noise ratio (Surface Roughness)

Table-VII: Response table of S/N ratio (Surface Roughness)

Level	Speed(rpm)	Feed(mm/rev)	DOC(mm)	Materials
1	-3.4689	-4.0880	-2.9181	-1.6915
2	-1.9743	-1.6889	-4.3748	-1.1413
3	-1.1484	-0.8143	**0.7016**	-3.7584
Delta	2.3203	3.2737	5.0764	2.6171
Rank	4	2	1	3

In the above response table VII showing optimum value 0.7016 based on effecting parameters at the smaller the better condition.

Table-VIII: Analysis of variance (ANOVA) of Means (Surface Roughness)

Source	DF	Seq SS	Adj SS	Adj MS	F-value	P-value
Speed(Rpm)	2	0.2138	0.2138	0.1069	*	*
Feed(Mm/Rev)	2	0.6467	0.6467	0.3233	*	*
DOC (Mm)	2	0.9785	0.9785	0.4892	*	*
Materials	2	0.3325	0.3325	0.1662	*	

Error	0					
Total	8	2.1714				

The analysis of variance was calculated to the Surface Roughness based up on the above response table and signal to noise ratio table. ANOVA table were obtained for the both Means and signal to noise ratio as show in the below tables VIII & IX.

Table-IX: Analysis of variance (ANOVA) of S/N (Surface Roughness)

Source	DF	Seq SS	Adj SS	Adj MS	F-value	P-value
Speed(Rpm)	2	8.299	8.299	4.150	*	*
Feed(Mm/Rev)	2	17.238	17.238	8.619	*	*
DOC(Mm)	2	40.994	40.994	20.497	*	*
Materials	2	11.424	11.424	5.712	*	*
Error	0					
Total	8	77.955				

H. Tool Wear

In the second step of machinability test L9 orthogonal array has taken. In this process 3 level design and 4 factors was taken. In the input level Surface Roughness taken as responsible data. The input data was analyzed so that Means and signal to noise ratio graphs were obtained as shown in below 11&12.

Table- X: L9 Orthogonal Array of Tool Wear

S. No	Speed (RPM)	Feed (mm/rev)	DOC (mm)	Materials	TWR (mm/sec)
1	1000	0.05	0.25	Al7A	1.935
2	1000	0.10	0.50	Al7G	1.572
3	1000	0.15	1	Al7S	2.132
4	1200	0.05	0.25	Al7A	1.987
5	1200	0.10	0.50	Al7G	0.831
6	1200	0.15	1	Al7S	1.652
7	1500	0.05	0.25	Al7A	0.949
8	1500	0,10	0.50	Al7G	1.387
9	1500	0.15	1	Al7S	1.258

Fig.11. Effecting parameters of Means (Tool Wear)

Table-XI: Response table of Means (Tool Wear)

Level	Speed(rpm)	Feed(mm/rev)	DOC(mm)	Materials
1	**1.890**	1.649	1.334	1.583
2	1.440	1.557	1.382	1.269
3	1.191	1.314	1.805	1.675
Delta	0.699	0.335	0.471	0.411
Rank	1	4	2	3

The above response table V showing optimum value 1.890 based on effecting parameters at nominal the best condition.

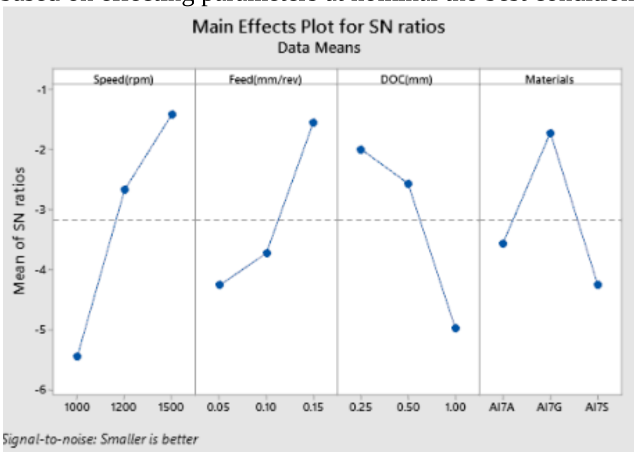


Fig.12. Effecting parameters of Means (Tool Wear)

Table-XII: Response Table(ANOVA) of S/N ratio (Tool Wear)

Level	Speed (rpm)	Feed (mm/rev)	DOC (mm)	Materials
1	-5.455	-4.264	-1.989	-3.563
2	-2.673	-3.726	-2.564	-1.721
3	-1.409	-1.546	-4.984	-4.253
Delta	4.046	2.718	2.995	2.532
Rank	1	3	2	4

The above response table XII showing optimum value -1.409 based on effecting parameters at nominal the best condition.

Table-XIII: Analysis of variance (ANOVA) of S/N ratio

Source	DF	Seq SS	Adj SS	Adj MS	F-value	P-value
Speed(Rpm)	2	0.7537	0.7537	0.37687	*	*
Feed(Mm/Rev)	2	0.1795	0.1795	0.08973	*	*
DOC(Mm)	2	0.4025	0.4025	0.20124	*	*
Materials	2	0.2796	0.2796	0.13982	*	*
Error	0					
Total	8	1.6153				

Table-XIV: Analysis of variance (ANOVA) of S/N ratio

Source	DF	Seq SS	Adj SS	Adj MS	F-value	P-value
Speed(Rpm)	2	25.70	25.7	12.851	*	*
Feed(mm/Rev)	2	12.43	12.43	6.214	*	*
DOC(mm)	2	15.16	15.16	7.579	*	*
Materials	2	10.28	10.28	5.140	*	*
Error	0					

IV. CONCLUSION

- The Microstructure of the metal matrix composites specimens consists of an Interdendritic network of eutectic silicon, MgSi in the matrix of an aluminum solid solution and ASTM grain size number is 5.
- The Impact Strength of Al7075 is 0.13J and Toughness is about 0.0035J/mm^3.In Izod test upon addition of 2.5% of Al_2O_3 and 5 % of Gr the Toughness value is increased by 20%, 12% respectively and the Toughness is decreased by 5%. Similarly the Impact Strength is decreased by 23%, 30%, 46% respectively compare to base alloy. In Charpy test the Toughness value is increased by 20%,17%and24% respectively. The Impact strength is increased by 20%, 20% in addition of 2.5% of Al_2O_3, and 5% of SiC. .Similarly the Impact strength is decreased by 20% in addition of 5% Gr respectively when compare to base alloy.
- In Brinell test, the hardness value of Al7075 is 100 BHN. Upon addition aluminum oxide, the hardness is increased by 9%. After addition of Graphite particles hardness value is decreased by 3% and finally addition Silicon Carbide the hardness value is increased by 28% comparative to the base material.
- In Rockwell test, the hardness value of Al7075 is 60 HRN. Upon addition aluminum oxide, the hardness is increased by 9%. After addition of Graphite particles hardness value is increased by 1% and finally addition Silicon Carbide the hardness value is increased by 6% comparative to the base material.
- The Tensile strength of the base material Al7075 showing higher value 220 N/mm^2 when compare to other composite materials because of the casting defects. Upon addition of aluminum oxide, the Tensile strength is decreased by 17%. After addition of Graphite particles hardness value is decreased by 12% and finally addition Silicon Carbide the Tensile strength value is decreased by 50% comparative to the base material.
- The better surface finish is obtained at speed 1500 rpm, feed 0.05 mm/rev and 1 mm depth of cut for the materials AL7075.
- The lowest Tool Wear occurred for the material AL7075 at1000 rpm, feed at 0.05 mm/rev and depth of cut at 0.25.

ACKNOWLEDGEMENT

The author are thank thankful to Dr. G.S Gupta, Professor and HOD Mechanical Engineering, VNR VJIET, Dr. E.V Ramana P.G Coordinator MED, Dr.M.S.Srinivasa Rao assist Professor, Ram babu lab assistant ,Murali Krishna lab assistant ,VNR VJIET, jyothi labs balanagar, raghavendra labs prashanthnagar.

REFERENCES

1. Mohanavel,V.,K.Rajan,S.SureshKumar,G.Vijayan,andM.S. Vijayanand. "Study on mechanical properties of Graphite particulates reinforced Aluminum matrix composite fabricated by stir casting technique." *Materials Today: Proceedings* 5, no. 1 (2018): 2945-2950.

2. Kandpal, Bhaskar Chandra, and Hari Singh. "Fabrication and characterisation of Al2O3/Aluminum alloy 6061 composites fabricated by Stir casting." *Materials Today: Proceedings* 4, no. 2 (2017):2783-2792.
3. Nagaral, Madeva, B. K. Shivananda, V. Auradi, K. I. Parashivamurthy, and S. A. Kori. "Mechanical behavior of Al6061-Al 2 O 3 and Al6061-Graphite composites." *Materials Today: Proceedings* 4, no. 10 (2017):10978-10986.
4. Ravikumar, K., K. Kiran, and V. S. Sreebalaji. "Characterization of mechanical properties ofAluminum/tungsten carbide composites." *Measurement* 102 (2017):142-149.
5. RohitAngiras, Onkar Singh Bhatia "analysis of Surface Roughness during turning operation of Aluminum6063usingTaguchiapproach*"International Journal of Advance Research In Science And Engineering* Vol.No.4, Issue 06, June (2015):202- 209.
6. Jha, Sujit Kumar, and Pramod K.Shahabadkar."ExperimentalInvestigation of CNC Turning of Aluminum Using TaguchiMethod." *International Research journal of Engineering and Technology* 2,no.3(2015).
7. Sambathkumar, M., P. Navaneethakrishnan, K. Ponappa, and K. S. K. Sasikumar. "Mechanical and corrosion behavior of Al7075 (hybrid) metal matrix composites by two step stir casting process." *Latin American Journal of Solids and Structures* 14, no. 2 (2017): 243-255.
8. Arulmani, L., and S. Santosh Kumar. "Experimental Investigation of Aluminium 7075BagasseAshGraphiteComposites." *International Journal of Materials Science* 11, no. 1 (2016): 27-31.
9. Shivakumar, N., V. Vasu, and N. Narasaiah. "Processing and dry sliding wear behavior of Al2O3 nanoparticles reinforcedZA-27 composites." *Materials Today: Proceedings* 4, no. 2 (2017): 4006-4012.
10. K. Ramesh "Optimization of Cutting Parameters for Minimizing Cycle Time in Machining of SS 310 using Taguchi Methodology and ANOVA." *IOSR Journal of Mechanical and Civil Engineering Volume* 12, Issue 1 Ver. IV (Jan- Feb. 2015) PP31-39.

AUTHOR'S PROFILE

Mr. Gourav Tiwari received his M.Tech (Computer Integrated Manufacturing) from National Institute of Technology, Warangal in 2016.presently working as assistant professor in VNR Vignana jyothi of Engineering and Technology, Hyderabad and having 3 years of experience in teaching field. He is also a member of Competency Development Cell (CDS) at VNR VJIET. He has organized and attended more than 10 workshops, training programs, Seminars etc.

Mr. P. Satya Dharma Teja received his B.Tech (MECH) from TMIST under JNTUH. Presently he is pursuing his M.TECH (AMS) in VNR VJIET. His area of interest is metal cutting operations fabrication of metal matrix composites.