EXPERIMENTAL INVESTIGATION OF TURNING FORCE ANALYSIS OF AL-SIC COMPOSITE

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Abstract

The main aim of our project is to investigate the cutting force , hardness and surface roughness of the material .In this project we are going to change the input parameters of the lathe Machine and analyze the result. Input parameters in lathe Machine are feed, spindle speed and depth of cut. Machinability will be conducted at different feed rates and cutting speeds to determine the surface roughness ,hardness and cutting forces. Result of the test indicate the performance of the cutting speed, feed, depth of cut and cutting force.

Keywords – *surface roughness ,hardness and cutting forces.*

I. INTRODUCTION

Al-based metal matrix composite has already been studied by many tool surface roughness in turning machining of 5%,10%,15% SiC aluminium material with coated and uncoated HSS tools. They concluded that surface roughness were mostly affected by cutting speed and coated tool which better results are provided have investigated the effect of processing parameters on surface roughness in machining of 15% SiC-AL. They have found that large chip depths and high cutting speeds reduce the surface roughness.is often a good predictor of performance of mechanical components since their regularities in the surface may form nucleation signs for cracks and corrosion ,reduce the fatigue life of components & increase wear. In Some cases surfaces should be rough as in case of bearings so as to hold the lubricating particles. Surface roughness is an important parameter in all machining processes such as in turning, milling, grinding etc. During machining the major factors that affect the surface roughness are cutting speed, feed rate, depth of cut, machine tool vibrations, temperature of cutting fluid, tool geometry etc., so it becomes important for the manufacturing industry to find the suitable levels of process parameters for obtaining desired surface roughness.

II. RELATED WORK

K. Venkatesanet al.[1], Metal matrix composites, in particular, Aluminium Hybrid Composites are gaining increasing attention for applications in air and land because of their superior strength to weight ratio, density and high temperature resistance. This paper presents the results of experimental investigation on machinability properties of Silicon Carbide and Boron Carbide reinforced Aluminium 356 hybrid metal matrix composite. The composites were prepared by varying weight fraction of SiC (5%, 10%, 15%) and keeping the Boron Carbide weight fraction (5%) is constant using modified stir casting technique. Four layer coated carbide insert (TiN. Al2O3, TICN, TiN) designated as CNMG 120408 FR was used to machine the fabricated composites. Face centered central composite experimental design coupled with Response Surface Methodology (RSM) was used for modeling that the process output characteristics that influence by weight fraction, speed, feed rate, cutting depth

P Ranjith Reddy et al [2] -Aluminium alloys have been increasingly applied as a structural material in composite materials using metal matrix due to their excellent mechanical properties and low weight. Aluminium is among those metals which are difficult to be welded by normal fusion welding processes. Aluminum MMC was particularly selected as it possesses increased elevated temperature strength and wide range of extensive applications. The excellent mechanical properties of these materials and relatively low production cost make them a very attractive candidate for a variety of applications both from scientific and technological viewpoints. Low melting point and high thermal conductivity are the two major factors contributing to this phenomenon. In our present work we have fabricated AA6061 composite material (in the shape of rod), an aluminium alloy, which is reinforced with Al_2O_3 in different quantities to improve machinability.

SudaranGhosh et al [3]The surface roughness and cutting force values were collected and analyzed for different sets of cutting speed, feed and depth of cut. RSM was used to find the optimal level of variables for cutting force and surface roughness. Through ANOVA analysis, it has been found that the cutting speed has major physical as well as statistical influence on the surface roughness (59.30 %) right after the depth of cut (9.1%) and the feed (7.0 %).

R.MohanRao et al[4] In this study, the PSO and Regression analysis was applied for analyzing surface roughness for two different compositions of Al/SiC composite. Based on experimental work, following conclusions were drawn., it is it is observed that Feed rate is found to be having minimum surface roughness at 0.05mm/rev at their by increasing up to 0.08mm/rev and then it is constant. it is observed that feed rate is the most influential factor and directly proportional for increase in surface roughness i.e., as feed increases the surface roughness also increases hence reduced feed is desirable for minimum surface roughness

M. Chaitanya et al[5] Metal matrix composites (MMC) are widely used composite materials in aerospace,automotive, electronics and medical industries. They have outstanding properties likehigh strength, low weight, high modules, low ductility, high wear resistance, highthermal conductivity and low thermal expansion. Aluminium-based SiC particle reinforced MMC materials have become useful engineering materials due to their properties such as low weight, heat-resistant, wear-resistant and low cost.

III. OBJECTIVES

1. The effect of cutting speed, feed, and depth of cut for AL-SiC composite in Lathe machining turning for surface roughness.
2. To minimizethe surface roughness various parameters and levels selected for carrying out the work.
3. To minimize surface roughness by changing the cutting speed, feed ,depth of cut input parameter in lathe machine
4. To maximize surface hardness by changing the cutting speed, feed ,depth of cut input parameter in lathe machine
5. To identify the minimum surface roughness value and maximum surface hardness value of the material

IV. WORKING PRINCIPLE

Lathe tool dynamometer is a equipment which used for the for observing the amount of load acting on the tool while operation by strain gauges . A dynamometer is a machine used to measure torque and rotational speed (rpm) from which power produced by an engine, motor, pump or other rotating prime mover can be calculated. The dynamometer should have sufficient mechanical rigidity to avoid excessive deformation of the cutting edge under the action of cutting force it should have sufficient sensitivity to enable measurement cutting force sufficient accuracy. it should have high stiffness and low mass ensuring transmissibility of force by its very high natural frequency .the sensor is designed in which way that it can be rigidly mounted on the tool post and the cutting tool can be fixed to the sensor directly.

V. DIAGRAM

Figure 1. 3D Diagram

VI. DESIGN OF EXPERIMENTS

SI NO	Spindle Speed (rpm)	Feed (mm/rev)	Depth Of cut (mm)	Fx (kgf)	Fy (kgf)	Fz (kgf)	Roughness (μm)
1	450	0.07	0.1	16.48	26.48	34.85	3.82
2	740	0.11	0.2	27.16	33.39	47.27	3.11
3	1150	0.16	0.3	29.79	38.04	47.79	3.94
4	450	0.07	0.1	18.18	27.40	37.95	2.81
5	740	0.11	0.2	14.31	20.36	26.61	2.02

6	1150	0.16	0.3	28.12	36.24	41.57	3.91
7	450	0.07	0.1	18.06	38.03	52.21	5.92
8	740	0.11	0.2	19.69	25.33	38.64	2.20
9	1150	0.16	0.3	38.33	31.56	55.97	3.24

VII. **Hardness Test for AL – SIC**

S.NO	**INDENT BALL DIA(inch)**	**MATERIAL**	**HARDNESS NUMBER**	**MATERIAL**	**HARDNESS NUMBER**
1.	1/16	Aluminium	36	Aluminium + Silicon carbide	59(5%SIC)
2.			38		61(10%SIC)
3.			35		76(15%SIC)
Average			36.3		65.3

VIII. AFTER MODIFICATIONS

Fig 2 After Machining process

IX. RESULTS AND DISCUSSION

The comparison of surface roughness for different depth of cut , feed and speed is shown on following tables.

PARAMETER	DEPTH OF CUT(mm)		
	0.1	0.2	0.3
Surface roughness Ra(µm)	3.82	3.11	3.94

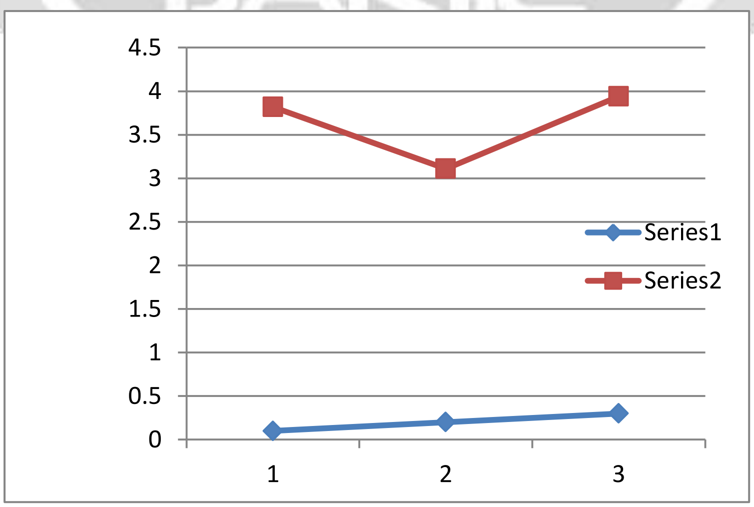

Fig 3. Depth of cut Vs surface roughness

X. CONCLUSION

Al-SiC has been selected for machining in lathe. When machining this, hardness of the Al-SiC (5%,10%,15) is greater than the pure aluminium. When increasing Cutting Speed and depth of cut the surface roughness is improved. The experimental results show that main cutting force has an increasing trend with the increasing of the feed rate Correspondingly power has been increased with cutting force. All the values of speed, feed, depth of cut and surface roughness are plotted in the graph.

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