Optimization Of Machining Parameters Of Lathe Machine In Turning Using Response Surface Methodology

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Abstract :**Aluminum oxide in helpful manner by dispersing it into aluminum oxide matrix to made composites by mechanical stir casting. Wide size varies (0.1- 100µm) aluminum oxide elements were used. The properties like tensile strength, hardness; toughness which is related to mechanical is investigated during my work. The experimental investigation of hybrid metal matrix composites with Aluminium and Alumina reinforced aluminum alloy (Al 6064) composites samples 5%, 10%,15%, 20%,25% and 30% volume fraction applied for the purpose of production and testing of the materials. Also the machining parameters of Lathe Machine in turning namely the speed, feed, depth of cut and nose radius are optimize by using response surface methodology. It takes Associate in nursing collective curiosity in mixtures having solidity and short price backups. Amid varied intermittently spread artifacts castoff, aluminum oxide is an amongst the foremost cheap then compactness strengthening out there massive amounts for instance solid excess through-invention throughout burning of coal in thermal power plants.**

***IndexTerms* - Alumina, utilization, lathe machine, industrial waste, reinforcement etc.**

I. INTRODUCTION

The past is typically noticeable by the materials and technology that replicate human ability understanding. over and over measures begins with the amount of your time, that semiconductor unit to the Bronze, Iron, Steel, Al and Alloy eons as developments in purifying, producing happened and science created of those accomplishable to maneuver towards result further advance materials accomplishable. Composite materials unit rising primarily in reply to extraordinary burdens after machinery because of fast proceeding goings-on in airplanes, half motorized businesses. All the constituents have low denseness which produces its belongings notably bigger in strength and modulus various typical engineering ingredients like metals. In place of a results of exhaustive readings into the important flora of materials and improved empathetic of their structure property relationship, it's become accomplishable to cultivate new merged materials with improved physical and mechanical belongings.

Appreciation of impending mass hoards that will be accomplished via victimization the innovative assortments that in casual implies that compact value besides bigger efficacy, was chargeable aimed at growing inside the equipment of assistances, matrices and production of mixtures. The recognition of the potential weight savings that can be achieved by using the advanced composites, which in turn means reduced cost and greater efficiency, was responsible for this growth in the technology of reinforcements, matrices and fabrication of composites.

1.1 COMPOSITES

A typical composite material is a system of materials composing of two or more materials (mixed and bonded) on a macroscopic scale. Generally, a composite material is composed of reinforcement (fibers, particles, flakes, and/or fillers) embedded in a matrix (polymers, metals, or ceramics). The matrix holds the reinforcement to form the desired shape while the reinforcement improves the overall mechanical properties of the matrix. When designed properly, the new combined material exhibits better strength than would each individual material. Composites consist of one or more discontinuous phases embedded in a continuous phase. The discontinuous phase is usually hard and stronger than the continuous phase and is called the 'reinforcement' or 'reinforcing material', whereas the continuous phase is termed as the ' matrix'.Properties of composites are strongly dependent on the properties of their constituent materials, their distribution and the interaction among them.

1.2 CLASSIFICATION OF COMPOSITE MATERIALS

(a) The three broad classifications of composites are on the basis of reinforcement:

(i) Particle reinforced composite: It consists of the composite material in which the filler materials are roughly round. An example of this type of composite would be the un-reinforced concrete where the cement is the matrix and the sand serves as the filler.

(ii) Fiber -reinforced composites : It is of two types short and long fiber composite .in short fiber composite , l /d ratio greater than one .Short fiber composites are generally taken to l /d of ~100 while long fiber type would have l /d ~ infinite . Fiber glass filler for boat panel is an example of short fiber composite. Carbon fibers, aramid fibers are some of the filler materials used in the long fiber composite.

(iii) Laminated composite: It is the type of the composite material in form of sheet instead of round particles or fibers .Formica countertop is a good example of this type of composite the matrix material is the phenolic type thermo set polymer. The filler could be any material from craft paper Formica) to canvas (canvas phenolic) to glass (glass filled phenolic).

(b) On the basis of Matrix composite can be classified in the following groups:

(i) Polymer-matrix composites (PMC) The most common matrix materials for composites are polymeric. Polyester and vinyl esters are the most widely used and least expensive polymer resins. These matrix materials are basically used for fiber glass reinforced composites. For mutations of a large number resin provide a wide range of properties for these materials .The epoxies are more expensive and in addition to wide range of ranging commercials applications also find use in PMCs for aerospace applications. The main disadvantages of PMCs are their low working temperature high coefficients of thermal expansion and hence dimensional instability and sensitivity to radiation and moisture.

(ii) Metal-matrix composites (MMCs) The matrix in these composites is a ductile metals .Due to their properties such as low density, high stiffness, and low coefficient of thermal expansion, high thermal conductivity, high strength and high wear resistance MMC have application in the automotive aviation space precision industry, defense, energy, and electronics work. Metal matrix composites are much more expensive those PMCs and, therefore, their use is somewhat restricted are low compared with metals and ceramics. Popular reinforcement materials for these composites are silicon carbide and alumina particles, while aluminium titanium and magnesium are the most common matrix materials.

(iii) Ceramic-matrix composites (CMCs) One of the main objectives in producing CMCs is to increase the toughness. Ceramics materials are inherent resistant to oxidation and distortion at elevated temperatures; were it not for their disposition to brittle fracture, some of these materials would be idea candidates for use in higher temperature and serve-stress applications, specifically for components in automobile an air craft gas turbine engines .The developments of CMCs has lagged behind mostly for main reason behind itis the most processing route involve higher temperature and only employed with high temperature reinforcements.

II. MATERIAL USED

2.1 Alumina As A Reinforcing Material

The predilection to use Alumina as a filler or underpinning in metal and polymer matrices is that Alumina is a produce of coal ignition, accessible in very large measures at very low costs since much of this is currently land filled. Currently, the use of artificial glass micro sphere has limited compliances due to mainly their more cost of production. Consequently, the material costs of mixtures can be compact meaningfully by including Fly ash into the matrices of polymers and metallic alloys. Though, small information is accessible on to aid in the design of composite materials, even though attempts have been made to integrate Alumina in both polymer and metal matrices. Chemosphere Alumina has a minor density than talc and calcium carbonate, but marginally higher than hollow glass. The cost of hollow glass is likely to be much heigher than Chemosphere. Chemosphere may turn out to be one of the lowest cost plasters in terms of the cost per volume.

2.2 Composition Of Matrix Material (Al6082)

Aluminum	Copper	Magnesium	Silicon	Iron	Manganese	Others
95.2- 98.5	0.1%	0.4-1.2%	0.6-1.3%	0.6%	0.4-1.0%	0.3%

III EXPERIMENTAL WORK

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The work materials used in the present work are aluminium alloy 6082 and aluminium oxide (Al_2O_3 as reinforcement). These materials are chosen due to their easily mixable property and gives good mechanical properties. First of all the aluminium alloy (Al6082) is heated

Fig. Lathe machine

up to its melting temperature in a electric furnace and then aluminium oxide is heated and mixed slowly in molten aluminium alloy with the help of stirrer. The mixer is left for cool down in the crucible in which it was melted and mixed. There are six samples in different ratios which are prepared for testing mechanical properties and choosing the best. The ratios are shown below in the Table.

Table 3.1 Composition selection

Material	**Sample 1**	**Sample 2**	**Sample 3**	**Sample 4**	**Sample 5**	**Sample 6**
Aluminium alloy (AA6082)	96.5%	94.0%	93.5%	91.%	88%	85%
Aluminium oxide (Al_2O_3)	3.5%	5.5%	6.5%	9%	12%	15%

Figure 3.1 Sample of aluminium + Al_2O_3 2.5 and 5% Alumina in Aluminium

Figure 3.2 Sample of aluminium + Al_2O_3 7.5 and 10% Alumina in Aluminium

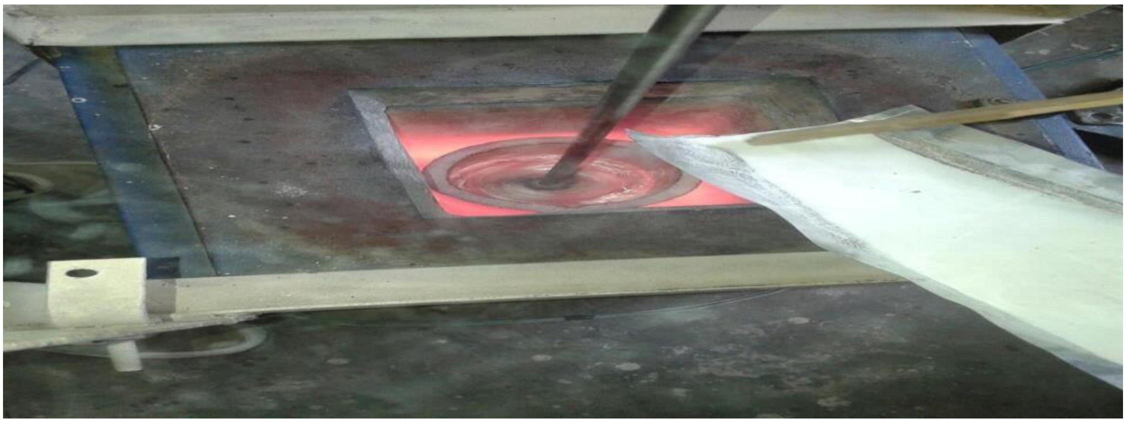

Figure 3.3 Preparation of sample by mechanical stir casting

3.1 OPTIMIZATION TECHNIQUE

Optimization is a process of arranging different input variables to get the best output. In this project optimizing the four parameters like feed rate, Depth of cut, speed and tool nose radius, and study the behavior of these parameters on dimensional deviation.

3.2 RESPONSE SURFACE METHODOLOGY

Response surface methodology (RSM) is a collection of mathematical and statistical techniques for empirical model building. By careful design of experiments the objective is to optimize a response (output variable) which is influenced by several independent variables (input variables). An experiment is a series of tests, called runs, in which changes are made in the input variables in order to identify the reasons for changes in the output response. Originally, RSM was developed to model experiments responses (Box and Draper in 1987) and then migrated into the modeling of experiments. In physical experiments, inaccuracy can be due ,for example, to measurement errors while, in computer experiments, numerical noise is a result of incomplete convergence of iterative processes, round -off errors or the discrete representation of continuous physical phenomena. In RSM the errors are assumed to be random. The most extensive applications of RSM are in the particular situations where several input variables potentially influence some performance measures or quality characteristics are called the response. The input variables are sometime called independent variables, and they are subjected to the control of the engineer or scientists. The field of response surface methodology consists of the experimental strategy for exploring the space of the process or independent variables, empirical statistical modelling to develop an appropriate approximating relationship between the yield and the process variables , and optimization methods for finding the values of the process variables that produce desirable values of the response. In this report i concentrate on the statistical modeling to develop an appropriate approximating model between the response y and independent variables $E_{1,}$ E2. En. In general the relationship is

$$Y = f(E1,E2,E3) + e$$

Where the form of the true response function f is unknown and perhaps very complicated, and E is a term that represents other sources of variability not accounted for in f .Usually E includes effects such as measurement error on the response, background noise, the effect of other variables, and so on. Usually E is treated as a statistical error, often assuming it to have a normal distribution with mean zero and variance, then Because the form of true response function f is unknown, we must approximate it.

$$E(y) = E\ [f\ (E1, E2, E3) + E\ (e) = f\ (E1, E2, E3)$$

IV. RESULT AND DISCUSSION

4.1 Analysis Of Microstructure

The microstructures of the MMC samples are seen using metallurgical microscope. When describing the structure of a material, we make a clear distinction between its crystal structure and its microstructure. The term ‘crystal structure’ is used to describe the average positions of atoms within the unit cell, and is completely specified by the lattice type and the fractional coordinates of the atoms. The term ‘microstructure’ in metal matrix composites is used to describe the appearance of the reinforcement material. A reasonable working definition of microstructure is “The arrangement of phases and defects within a material.”

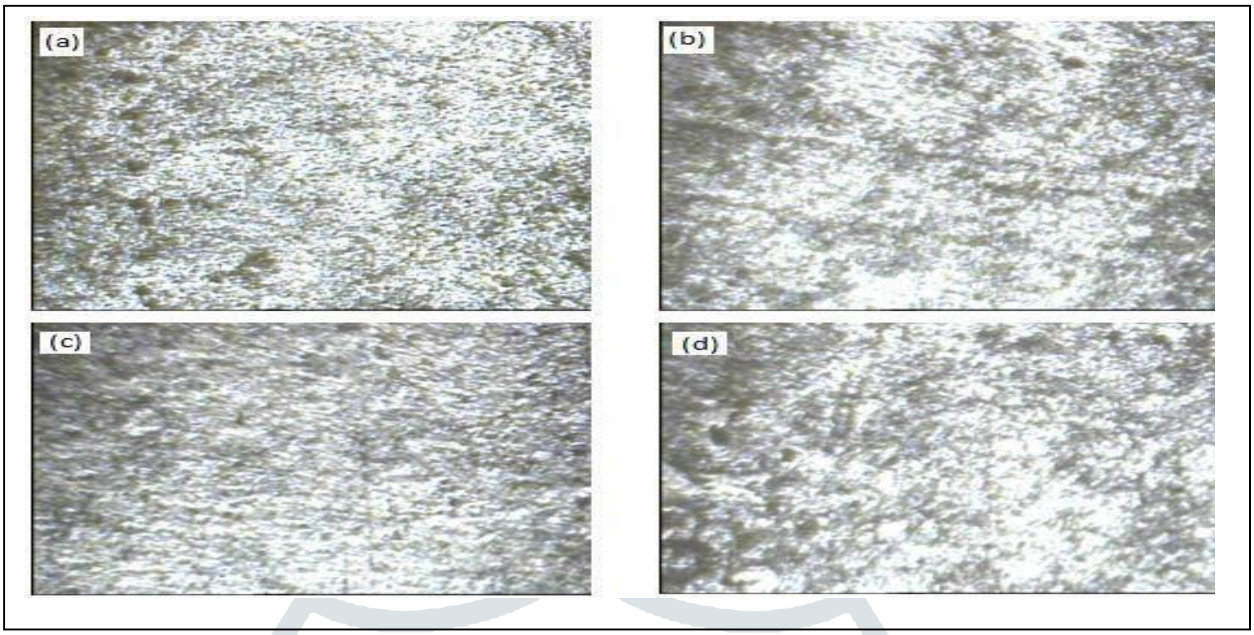

Figure 5.1 Microstructure of different samples

(a) 2.5% reinforcement, (b) 5% reinforcement, (c) 7.5% reinforcement, (d) 10% reinforcement

4.2 ANALYSIS OF TENSILE STRENGTH

The tensile testing of MMC is carried out on Tensometer machine. Tensometer is a device used to evaluate the tensile properties of materials such as their Young's modulus and tensile strength. It is usually a universal testing machine loaded with a sample between two grips that are either adjusted manually or automatically to apply force to the specimen. The machine works either by driving a screw or by hydraulic ram. Testing is done by clamping the specimen in the jaws of the Tensometer

Fig. 4.2. Tensile Testing on Tensometer

Table 5.1 Tensile Test Results

Samples (of Al_2O_3)	**Ultimate strength(N)**	**ongation (mm)**	**ak load (N)**	**Break Elongation (mm)**	**True UTS (N/ sq mm)**	**Area (sq. mm)**
2.5%	699.8	0.53	148.3	0.63	26	28.386
5.0%	637.5	0.5	205.9	0.67	22.9	28.186
7.5%	1398.1	2.16	1008.3	2.50	62.2	26.123
10%	441.3	0.38	304	0.54	15.8	28.286
12.5%	342	0.32	298	0.48	14.9	26.282
15 %	308	0.30	282.2	0.39	14.5	25.832

V.CONCLUSION

The following conclusions can be drawn from analysis;

1. Within the investigated range of process parameters, lower speed (100 m/ min), lower feed (0.15 mm/rev.) and lower depth of cut (0.20 mm) and rake angle (-9 .00) are preferred for low dimensional deviation of machined A6064/7.5% Al_2O_3 metal matrix composite.
2. Within the process parameters range; dimensional deviation of machined A6064/7.5%Al_2O_3 metal matrix composite decreases, by increasing the speed, feed rate and depth of cut and increases by increasing rake angle.
3. Mechanical properties are improved by adding the reinforcement material Alumina at 7.5% in Al6064.
4. The value of dimensional deviation is 2.5933

VI FUTURE SCOPE

The present work has been completed but permits way for further work in future:

- The work can be carried out by making use of other design technologies like fractional factorial design, design expert tools, Box bancken design etc.
- Composite can be prepared by other matrix material and other reinforcing materials like SiC, B4C etc.
- The work can be carried out by taking more machining parameter like feed, Speed, Depth of cut, Rake angle, Nose radius, Coolant use etc.

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