A Review on Optimization of Process Parameter in Cylindrical Grinding of Austenitic Stainless Steel Rod (AISI 316 L) by Taguchi Method

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Abstract

In the machining process, there are some different factors which exert influence on material removal rate (MRR), including cutting condition, tool variables, machine speed and work piece variables. In the cylindrical grinding process (CGP), it is difficult to consider all process parameters that device MRR because it needs much experimentation which results in the consumption of money, time and human resources. Thus, this study investigated the impact of process parameters in external CGP for AISI 316L steel material using the Taguchi method. The performed experiments considered through the L9 orthogonal array on a cylindrical grinding machine. The originality of this study is based on the presence of fewer or probably no experimental investigation on the AISI 316L material as the work piece that has been performed antecedent in optimizing process parameters using the Taguchi method on external cylindrical grinding and MRR. Thus, the obtained results are more important after having the established machining parameters for AISI 316L steel materials. The main aim in any machining process is to increased the Metal Removal Rate (MRR) and to decreased the surface roughness value. To optimize these values by using Taguchi method, ANOVA and regression analysis is used.

Keywords- *Cylindrical grinding, Taguchi method, ANOVA, Work speed, feed rate, depth of cut.*

I. INTRODUCTION

Granulating is a material removal and surface generation process used to shape and finish components made of metals and other materials. The accuracy and surface completion acquired through crushing can be to multiple times better than with either turning or processing. Granulating utilizes a rough item, typically a pivoting wheel carried into controlled contact with a work surface. The crushing wheel is made out of grating grains held together in a folio. These grating grains go about as cutting apparatuses, expelling small chips of material from the work. As these rough grains wear and become dull, the additional obstruction prompts crack of the grains or debilitating of their bond. The dull pieces split away, uncovering sharp new grains that keep cutting. The necessities for productive pounding include:

- Abrasive components which are harder than the work.
- Shock- and heat-resistant abrasive wheels.

The accuracy and surface completion acquired through crushing can be to multiple times better than with either turning or processing. Granulating utilizes a rough item, typically a turning wheel carried into controlled contact with a work surface. The pounding wheel is made out of grating grains held together in a cover. These grating grains go about as cutting apparatuses, expelling minor chips of material from the work. As these rough grains wear and become dull, the additional obstruction prompts crack of the grains or debilitating of their bond. The dull pieces split away, uncovering sharp new grains that proceed cut That is, they are equipped for controlled cracking Most abrasives utilized in industry are manufactured. Aluminium oxide is utilized in seventy five percent of all crushing tasks, and is basically used to pound ferrous metals. Next is silicon carbide, which is utilized for crushing gentler, non-ferrous metals and high thickness materials, for example, established carbide or earthenware production. Super abrasives, to be specific cubic boron nitride or "CBN" and precious stone, are utilized in around five percent of crushing. Hard ferrous materials are ground with "CBN", while non-ferrous materials and non-metals are best ground with precious stone. The grain size of rough materials is imperative to the procedure. Enormous, coarse grains expel material quicker, while littler grains

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produce a better completion. The folios that hold these grating grains together include: • Vitrified bonds, a glass-like bond framed of combined mud or feldspar

- Organic bonds, from engineered saps, elastic, or shellac
- Metal or single-layer bond frameworks for super abrasives

There are numerous types of crushing, yet the four significant mechanical granulating forms are:

- Cylindrical granulating
- Internal granulating
- Centre less granulating
- Surface granulating

In surface granulating, the work piece is fixed and the pounding wheel turns with high speed. Surface granulating produces an outside surface that might be straight, decreased, or moulded. The essential parts of a surface processor incorporate a wheel head, which join the shaft and drive engine; a cross-slide, which moves the wheel head to and from the work piece; which finds, holds, and drives the work piece.

The assembling procedure of focus less granulating has been set up in the large scale manufacturing of thin, rotationally balanced parts. Because of the mind boggling set-up, which results from the huge affectability of this pounding procedure to an assortment of geometrical, kinematical and dynamical impact parameters, focus less crushing is once in a while applied inside restricted parcel creation. The significant qualities of this crushing procedure are the concurrent direction and machining of the work piece on its outskirts. Surface granulating is a fundamental procedure for last machining of segments requiring smooth surfaces and exact resistances. As contrasted and other machining forms, granulating is exorbitant activity that ought to be used under ideal conditions. Albeit broadly utilized in industry, crushing remains maybe the least comprehended of all machining forms. The major working information parameters that impact the yield reactions, metal evacuation rate, surface harshness, surface harm, and instrument wear etc., are: (I) wheel parameters: abrasives, grain size, grade, structure, fastener, shape and measurement, and so forth., (ii) Work piece parameters: break mode, mechanical properties and synthetic synthesis, and so forth., (iii) Process parameters: work speed, profundity of cut, feed rate, dressing condition, and so on., (iv) machine parameters: static and dynamic Characteristics, axle framework, and table framework, and so forth. The proposed work takes the accompanying information forms parameters in particular Work speed, feed rate and profundity of cut.

II. LITERATURE REVIEW

By referring nesredin chekole deresse and vivek Deshpande concluded that the inpact of process parameters in external cylindrical grinding process for AISI 316L material by using taguchi method . The considered machining variables are depth of cut , feed rate , work speed as response parameters before and after heat treatment process . The effect of input and output parameters was described through the “signal to noise ratio” (SNR) and “analysis of variance (ANOVA)” using minitab 18 software . Deepak pal conducted experiments on universal tool and cutter grinding machine with L9 orthogonal array with input machining variables as work speed , grinding wheel grades and hardness of material .

III. METHODOLOGY AND EXPERIMENTATION

The objective of trial work is to explore the impact of crushing parameters with the procedure parameters of cutting pace, feed rate and Depth of cut affecting the metal evacuation pace of AISI 316L Austenite hardened steel. i. Selection of material for work piece

ii. Selection of philosophy for granulating process improvement (Taguchi technique for enhancement)

Table 1 :-Methodology

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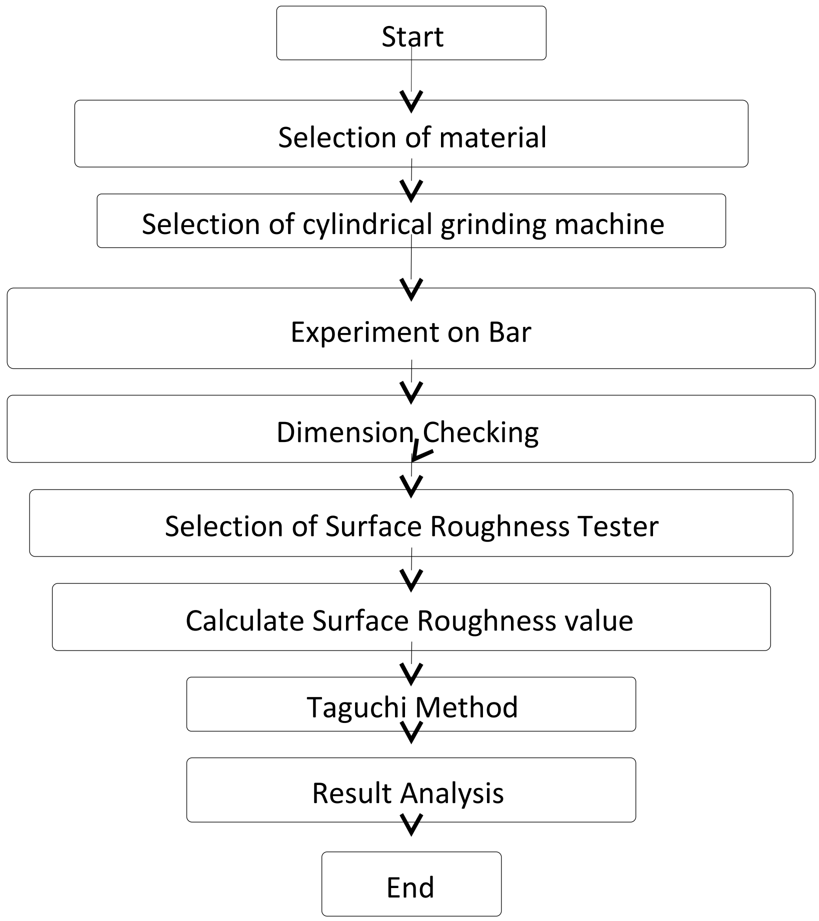

IV. EXPERIMENTATION :-

Parameters-3

1. Rotational speed-e.g. A, B, C
2. Feed- e.g. P, Q, R
3. Depth of cut- e.g .L, M, N

Here there are total three levels for each parameter. Therefore refer Taguchi table of orthogonal arrays L9.

Table 2 :- naming of parameters

EXPERIMENT	ROTATIONAL SPEED	FEED	DEPTH OF CUT

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1	A	P	L
2	A	Q	M
3	A	R	N
4	B	P	L
5	B	Q	M
6	B	R	N
7	C	P	L
8	C	Q	M
9	C	R	N

V. SELECTION OF PARAMETERS :-

The Range of Rotational speed, Feed and Depth of cut are shown

Table 3 :- selection of parameters ranges

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Sr . No	Process Parameters	Range	Level 1	Level 2	Level 3
1	Rotational speed	150-250 m/min	150	200	250
2	Feed	0.2-0.4 mm/rev	0.2	0.3	0.4
3	Depth of cut	0.1-0.3 (mm)	0.1	0.2	0.3

VI. RESULTS :-

Weight of specimen before and after experiment

Table 3:- weight of specimen before and after the experiment

SR.NO	WEIGHT OF SPECIMEN BEFORE PROCESS.(GM)	WEIGHT OF SPECIMEN AFTER PROCESS. (GM)	WEIGHT DIFFERENCE (GM)
1	1479	1474	5
2	1473	1470	3
3	1472	1468	4
4	1472	1470	2
5	1480	1468	12
6	1472	1469	3
7	1472	1463	9
8	1477	1472	5
9	1481	1472	9

VII. OBSERVATION TABLE :-

Table 4 :- observation table

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SR.NO	SPEED (M/MIN)	FEED (MM/REV)	DEPTH OF CUT (MM)	TIME (SEC)	SURFACE ROUGHNESS VALUE (RA)	MRR (gm/sec)
1	150	0.2	0.1	33	1.26	0.151
2	150	0.3	0.2	43	0.96	0.069
3	150	0.4	0.3	48	1.61	0.083
4	200	0.2	0.2	44	1.40	0.045
5	200	0.3	0.3	52	1.24	0.230
6	200	0.4	0.1	33	1.21	0.090
7	250	0.2	0.3	53	1.91	0.168
8	250	0.3	0.1	33	1.34	0.151
9	250	0.4	0.2	41	1.13	0.212

VIII. DISCUSSION :-

- An austenitic treated steel delivers better surface complete the process of during tube shaped granulating process in pounding process parameters.
- Very high resilience worth can be gotten in round and hollow pounding.
- In barrel shaped crushing the profundity of cut assume a significant job and produce greatest metal evacuation (MRR) rate in austenitic treated steel.
- Austenitic treated steel have great mach failure property.
- The barrel shaped granulating advances parameters to conquer the issue of poor chip breaking and machining disappointment.

IX. CONCLUSIONS

The paper is about the effect of Depth of Cut, Feed Rate and Work Speed parameters as machining parameters on Cylindrical Grinding

Process. The experiments for this study AISI316L is used mild steel .The machine and wheel used are a hydraulic cylindrical grinder and he silicon carbide (SiC) wheel respectively.

As per experimental work the following conditions are obtained from high material removal rate as good surface finishing value.

- For high material removal rate :

Speed (m/min)	**Feed (mm/rev)**	**Depth of cut (mm)**	**Material removal rate (gm/sec)**
200	0.3	0.3	0.230

- For low surface roughness value :

Speed (m/min)	**Feed (mm/rev)**	**Depth of cut (mm)**	**Surface roughness value (Ra)**
150	0.3	0.2	0.96

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