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OPTIMIZATION OF DRILLING PARAMETERS OF SS316 BY TAGUCHI METHOD

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ABSTRACT

Drilling operation is widely used in metal cutting industries, because of their wide the conventional drilling is used in commercial application. Although modern metal cutting methods have improved in the manufacturing industries, but conventional drilling still remains one of the most common machining. In this study, focuses on the optimization of drilling parameters using the Taguchi technique to obtain minimum surface roughness (Ra) and hole diameter, circularity error & ovality test. The experiments were performed on SS 316 using HSS, TiN coated & Black Oxide twist drills were used under dry cutting conditions with various end point angle speed and feed. The measured results were collected and analysed with the help of the commercial software package MINITAB17.

KEYWORDS: Drilling, Taguchi Method, Analysis of Variance, SS316, MINITAB17.

I. INTRODUCTION

Drilling is a major of hole making process. Drilling is the cutting process of using a drill bit in a drill to cut or enlarge holes in solid materials, such as wood or metal. Different tools and methods are Hole making is among the most important operations in manufacturing. used for drilling depending on the type of material, the size of the hole, the number of holes, and the time to complete the operation. It is most frequently performed in material removal and is used as a preliminary step for many operations, such as reaming, tapping and boring. The cutting process in which a hole is originated or enlarged by means of a multipoint, fluted, end cutting tool. As the drill is rotated and advanced into the work piece, material is removed in the form of chips that move along the fluted shank of the drill.

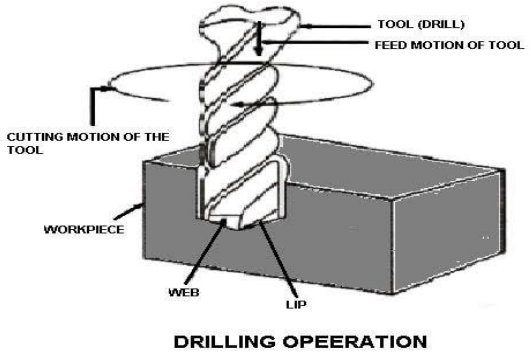

Figure 1.1 Drilling operation on the work piece

Although long spiral chips usually result from drilling, adjustment of the feed rate can result in chips with a range of many different shapes and sizes. Material of work piece can also change the range of different chip shapes and sizes generally, the hole diameters produced by drilling are slightly larger than the drill diameter (oversize). The amount of oversize depends on the quality of the drill and also the equipment that used as well as the machinist skill.

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II. PROBLEM IDENTIFICATION

The important goal in the modern industries is to manufacture the products with lower cost and with high quality in short span of time. There are two main practical problems that engineers face in a manufacturing process.

1. The first is to determine the values of process parameters that will yield the desired product quality.
2. Second is to maximize manufacturing system performance using the available resources.

III. METHODOLOGY

Drilling is a major and common of hole making process. Drilling is during this project the procedure will follow to calculate the result of response surface methodology by using the MATLAB software. The next step is that the experiments will performed in a VMC machine. The main drilling parameters that are involved during machining process as follow as

- Speed
- Feed
- Depth of cut

The below three drilling parameters are the key factor for the machining properties of the work piece. The mechanical properties of stainless steel are quite different from those of carbon steel. For carbon and low-alloy steels, the proportional limit is assumed to be at least 70 % of the yield point, but for stainless steel the proportional limit ranges from approximately 36 % - 60 % of the yield strength.

Table: 1.1 Chemical Composition of various stainless

Stainless Steel grade properties								
SINO	GRADE NAME	%C	%Si	%MN	%P	%Cr	%Ni	%Fe
1	301	0.15	1	2	0.045	16	6-8	Balance
2	304	0.08	0.75	2	0.045	18	8	Balance
3	305	0.12	1	2	0.045	18	12	Balance
4	310	0.25	1.5	2	0.045	24	19	Balance
5	316	0.08	0.75	2	0.045	16	14	Balance
6	321	0.08	0.75	2	0.045	17	9-12	Balance

DRILL BITS; There are three drill bit used follow.

Figure 1.2: HSS drill bit

Table 1.2 HSS properties Chemical Composition

Sl No	Carbon	Silicon	Manganese	Chromium	Tungsten	Vanadium
1	2.0	-	2.5	-	7.0	-

Figure 1.3 Black oxide Drill Bit

Table 1.3 Black Oxide drill bit Chemical Composition

Sl N0	Carbon	Chromium	Molybdenum	Tungsten	Vanadium	Cobalt
1	1.10	3.75	9.50	1.50	1.15	8.00

Figure 1.4 TiN coated drill

Table 1.4 TiN coated drill bit chemical composition

Sl No	Carbon	Chromium	Molybdenum	Vanadium	Manganese	Silicon
1	2.00	1.75	-	0.75	3.50	1.82

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Figure 2: VMC Machine

Figure 3: Before machining of SS316

Figure 4: After machining of SS316

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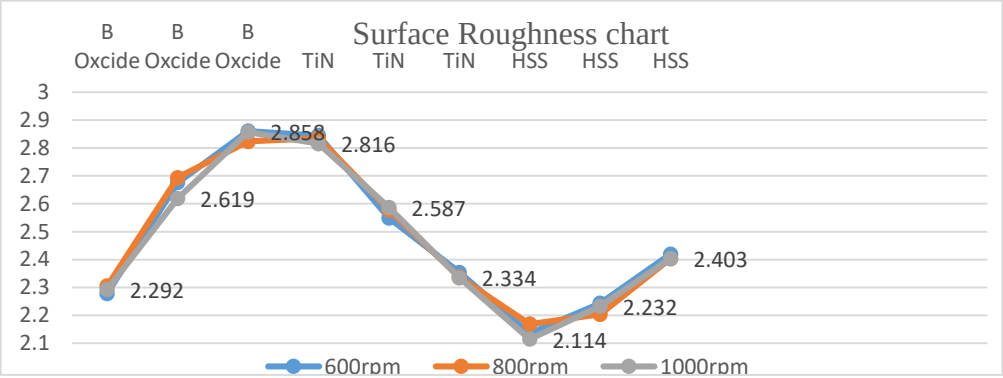
IV. RESULTS AND DISCUSSIONS

By using the taguchi method we have conducted the three test as surface roughness, circularity and ovality on the verity of samples in the presence of standard environment condition and the measurement has been tabulated as follows

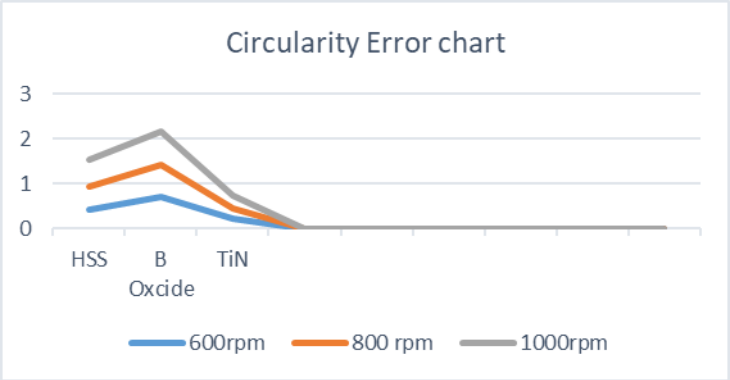
Surface Roughness test

Experiment No	Tool Material	Surface Roughness (µm)			Average surface roughness (µm)
		Trial 1	Trial 2	Trial 3	
1	Black Oxide	2.278	2.305	2.292	2.291
2	Black Oxide	2.676	2.694	2.619	2.663
3	Black Oxide	2.861	2.824	2.858	2.684
4	TiN	2.845	2.836	2.816	2.832
5	TiN	2.549	2.578	2.587	2.571
6	TiN	2.354	2.337	2.334	2.341
7	HSS	2.135	2.168	2.114	2.139
8	HSS	2.243	2.203	2.232	2.226
9	HSS	2.419	2.403	2.403	2.408



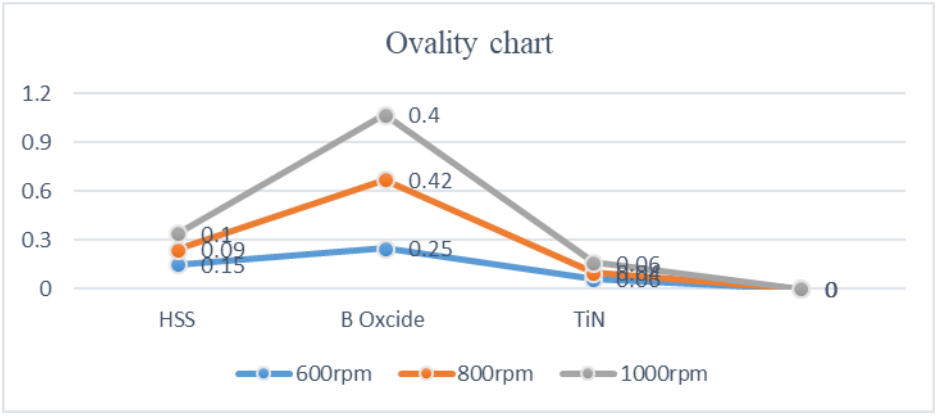
Circularity Error test

SI NO	TOOL MATERIAL	PARAMETER (CIRCULARITY) MM
1	HSS Tool	0.417
2	HSS Tool	0.518
3	HSS Tool	0.601
4	Black Oxcide Tool	0.723
5	Black Oxcide Tool	0.689
6	Black Oxcide Tool	0.745
7	TiN Tool	0.228
8	TiN Tool	0.231
9	TiN Tool	0.287



Ovality test

SI NO	TOOL MATERIAL	PARAMETER (OVALITY) MM May or (UM)
1	HSS Tool	0.15
2	HSS Tool	0.09
3	HSS Tool	0.10
4	Black Oxcide Tool	0.25
5	Black Oxcide Tool	0.42
6	Black Oxcide Tool	0.40
7	TiN Tool	0.06
8	TiN Tool	0.04
9	TiN Tool	0.06



V. CONCLUSION

As a result of the Taguchi experimental trials, it was found that the speed is the most significant factor for the surface roughness with contribution percentage of 50% respectively. The optimum process parameter for surface roughness is spindle speed

1. 600rpm, feed rate 3, 0.06 mm/rev and Tool Material

2. Black oxide drill bit. The optimum parameter for Circularity Error was spindle speed 2. 800rpm, feed rate 1, 0.02 mm/rev and Tool Material

3. TiN coated drill bit and feed was the most significant factor for Circularity Error with contribution percentage of 47 % respectively.

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VI. REFRENCES

[1] A. Navanth, T. Karthikeya Sharma, A study of taguchi method based optimization of drilling parameter in dry drilling of al alloy at low speeds, ijeset volume 6, issue 1, pp: 65-75.
[2] J. Prasanna, L. Karunamoorthy, M. Venkat Raman, Sai Prashanth, D. Raj Chordia, Optimization of process parameters of small hole dry drilling in Ti–6Al–4V using Taguchi and grey relational analysis, ScienceDirect, 2014.
[3] Ula¸s Çayda¸s, Ahmet Hasçalık, Ömer Buytoz, and Ahmet Meyveci, Performance Evaluation of Different Twist Drills in Dry Drilling of AISI 304 Austenitic Stainless Steel, Materials and Manufacturing Processes, 2011, pp: 951–960.
[4] .M. Balaji, B.S.N. Murthy, N. Mohan Rao, Optimization of Cutting Parameters in Drilling Of AISI 304 Stainless Steel Using Taguchi and ANOVA, Procedia Technology, 2016 pp: 1106 – 1113.
[5] Gaurav Chaudhary, Manoj Kumar, Santosh Vermac Anupam Srivastavd, Optimization of drilling parameters of hybrid metal matrix composites using response surface methodology, Procedia Materials Science, 2014 pp: 229 – 237 6 Suman Chatterjee, Siba Sankar Mahapatra, Kumar Abhishek, Simulation and optimization of machining parameters in drilling of titanium alloys, Simulation Modelling Practice and Theory, 2016 pp: 31–48.
[6] V.Balakumaran , C. Parthasarathy, and J.Chandradass, Optimization of Drilling Parameters on EN31 Steel with Chromium Coated Drill Bit by Using TAGUCHI Method, Procedia Material Science Vol. 4 No. 2, 2015, pp. 18-22.
[7] Nayan G Kaneriya, Gaurav Kumar Sharma, Experimental Evaluation and Optimization of Dry Drilling Parameters of AISI304 Austenitic Stainless Steel using Different Twist Drills, AIMTDR, 2014. Sumesh A S, Melvin Eldho Shibu, Optimization Of Drilling Parameters For Minimum Surface Roughness Using Taguchi Method, IOSR-JMCE2014 pp: 23202334.
[8] Arshad Noor Siddiqueea, Zahid A. Khana, Pankul Goelb, Mukesh Kumarb, Gaurav Agarwalb, Noor Zaman Khana, Optimization of Deep Drilling Process Parameters of AISI 321 Steel using Taguchi Method, Procedia Materials Science 6 2014 pp: 1217 – 1225.
[9] Himanshu Gupta, Umesh Kumar Vates, Shubhm Sharma, Gyanendru Kumar Singh, and Vivek Kumar, Optim ization of Influencing Drilling Parameters in HSS T1 Using Reponse Surface Methodology, Middle-East Journal of Scientific Research, 2010 pp: 3067-3077.
[10] A. Madhan Kumar, N. Dinesh Kumar, L. Raj Kumar, Investigation Of Drilling Time In Ss304 (Austenitic Stainless Steel) With Different Cutting Environments, IJETCSE, Volume 21 Issue 3 2016.
[11] Kunal Sharma, Mr. Abhishek Jatav, Optimization of Machining Parameters in Drilling of Stainless Steel, IJSRET, Volume 4, Issue 8, 2015.
[12] Mr. N.S.Kurzekar, Prof M.S. Tufail, A review on optimization of drilling process parameters of AISI 304 austenite stainless steel by using response surface methodology, IJEDR Volume 4, Issue 2 2016. Sudha Kumari, Kapil Kumar Goyal and Vivek Jain,Optimization Of Cutting Parameters For surface Roughness Of Stainless Steelss316