

Influence of Tool Wear for Different Materials AA6085 & SS316l by Using Twist Drill Bit (HSS)

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ABSTRACT: Almost half of the world's industries and production is done by using stainless steel. It is not easy to machine materials their high strength, high ductile and low thermal conductivity. This paper discuss the influence of tool wear and drilling time of SS316L(Stainless steel) & AA6085 (Aluminum alloy)factor like spindle speed, feed rate affect the performance parameter with various cutting environment such as Normal castor oil mix with water. This paper present the multi-objective optimization of drilling process parameter using Orthogonal Array method in machining of SS316L (Stainless steel) & AA 6085 (Aluminum alloy). The main aim is to find out the minimum tool wear and machining time of drilling SS316L (Stainless steel) & AA6085 (Aluminum Alloy). The experiments are conducted based L9 orthogonal array by taking machining time, feed rate and spindle speed at three level. The orthogonal array analysis is used to obtain the relation between the machining parameters and performance characteristics.

KEYWORDS: AA6085, SS316l, Drilling time, cutting environments, tool wear, WEDM, SEM

I. INTRODUCTION

When investigating the research methodology in the earth sciences, there is vast usage of stainless steel and aluminium in the world of machine manufacturing. There is no widely agreed criterion based definition of heavy metal. Different meanings may be attached to the term, depending on the context. In metallurgy, a heavy metal may be defined based on the density, whereas in physics the distinguished criterion might be atomic number, and the chemist would likely be more concerned with chemical behavior. Definition based on atomic number have been criticized for including metal with low densities. Criteria based chemical behavior or periodic table position have been used or suggested. In metallurgy, stainless steel, also known as inox steel or inox from French inoxidizable (inoxidizable), is a steel alloy with a minimum of 10.5% chromium content by mass. Stainless steel is notable for its corrosion resistance, and it is widely used for food handling and cutlery among many other applications. Stainless steel does not readily corrode, rust or stain with water as ordinary steel does. However, it is not fully stain-proof in low-oxygen, high-salinity, or poor air-circulation environments. There are various grades and surface finishes of stainless steel to suit the environment the alloy must endure. Stainless steel is used where both the properties of steel and corrosion resistance are required.

II. EXPERIMENTAL SETUP

In this work, effects of drilling parameters (feed rate and spindle speed) on the twist drill bit temperature in drilling of austenitic stainless steel material with and without the use of coolant is experimentally investigated. During drilling experiments, the drill bit temperature was measured by using SMART SENSOR AR360 Infrared Thermometer. The performance parameters viz. feed rate and spindle speed are varied as per L9 orthogonal array. The experiments

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were conducted by using High Speed Steel (HSS) drills having 82°, 100° and 118° drill point angles respectively. Analysis of temperature on the drilling parameters concluded that, the drilling temperature of the specimen increases with increase in both cutting speed and feed rate. This work thoroughly construes that 118° drill point angle produced the highest drilling temperature during the specimen drilling. Thus in order to reduce the thermal effects during machining of the specimen, the 80° drill point angle is recommended.



(a)Drilling machine setup

Aluminium :

Grade	6085
Dimension	194*104*10 in mm
Weight before machining	0.540 kg
Weight after machining	0.525 kg

Stainless Steel:

Grade	316L
Dimension	194*104*10 in mm
Weight before machining	1.620 kg
Weight after machining	1.565 kg

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(b) Base material-AA6085



(c) Base material-SS316L



(d) Drill Bit HSS-dia 10mm

Drilling is easily the most common machining process. One estimate is that 75% of all metal-cutting material removed comes from drilling operations. Drilling involves the creation of holes that are right circular cylinders. This is accomplished most typically by using a twist drill, something most readers will have seen before. The figure below illustrates a cross section of a hole being cut by a common twist drill. The chips must exit through the flutes to the outside of the tool. As can be seen in the figure, the cutting front is embedded within the work piece, making cooling difficult. A view of the metal-cutting area of a drill press is shown below. The work piece is held in place by a C-clamp since cutting forces can be quite large. It is dangerous to hold a work piece by hand during drilling since cutting forces can unpredictably get quite large and wrench the part away. Wood is often used underneath the part so that the drill bit can overshoot without damaging the table. The table also has holes for drill overshoot as well as weight reduction. A three-jaw chuck is used since three points determine a circle in two dimensions. A view of the metal-cutting area of a drill press is shown below. The work piece is held in place by a C-clamp since cutting forces can be quite large. It is dangerous to hold a work piece by hand during drilling since cutting forces can unpredictably get quite large and wrench the part away. Wood is often used underneath the part so that the drill bit can overshoot without damaging the table. The table also has holes for drill overshoot as well as weight reduction.

Machining Process

The material Al 6085 and SS316L was bought in dimension 193*104 each. Twist drill of HSS (10mm) was used to drill the metal plate. Drill is made for three different speeds like 132 ,220,350 in each metal plate with feed rate of 0.2, 0.4, 0.6 respectively. Each and every time when we drill the metal time taken for drilling the metal is noted for each speed with respective feed. As drilling is made the metal and tool gets heated. Hence to reduce the heat we use

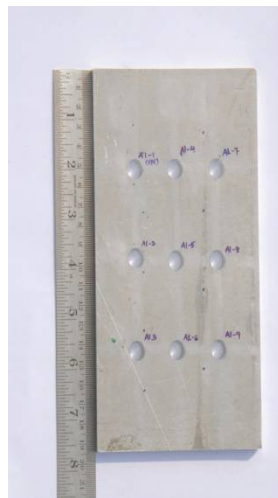
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coolant to reduce the temperature. The coolant is used as cutting environment which is the mixture of Castrol oil and water. Machine used is vertical milling machine for this drilling process. The experiments are conducted based L9 orthogonal array by taking machining time, feed rate and spindle speed at three level.



(e)Machined Holes-AA6085



(f)Machined Hole-SS316L

Wire cut EDM

Wire-Cut EDM, a thin single-strand metal wire is fed through the work piece, typically occurring while in a submerged tank of dielectric fluid or deionized water. This fluid helps to cool the process and flush away the cut material. The Wire EDM process uses electric current to cut conductive materials leaving a smooth surface that requires no further finishing or polishing. This process is used to cut plates and to make punches, tools, and dies from any conductive material, including hard metals that are too difficult to machine with other methods, such as; metal alloys, graphite, carbide and diamond. The wire is held between upper and lower diamond guides. The guides move in the (X-Y) plane controlled by a CNC, the upper guide can also move independently in the (Z-U-V) axis, giving rise to the ability to cut tapered and transitioning shapes and can control axes movements. This gives the Wire-Cut EDM the ability to be programmed to cut very intricate and delicate shapes. Wire EDMing is commonly used when low residual stresses are desired. Wire EDM has no added residual stress because it has no cutting forces. There is little change in the mechanical properties of a material in Wire EDMing due to its low residual stresses.

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(g) Wire Cut EDM Setup

NAME	PARAMETERS
Abrasive material	Brass coated
Machine model	AQ300 SODICK
Frequency	0.3
Cutting time	5 min



(h) Brass Wire –WEDM Tool

Wire EDM generates an electrical discharge between the work piece (metal) and the wire for EDM machine, as the wire is continuously fed. This melts and cuts the metal in a way similar to a fret saw. The diameter of the wire is determined according to the shape and thickness of the metal to be machined. A wire of 0.1 to 0.3mm in diameter is typically used. The metal to be machined is melted and cut by the discharge, but the wire is partially consumed at the same time, as a discharge trace is formed. (The trace is created when the wire surface melts and splatters.) The partially consumed wire has insufficient strength to withstand any significant tension. Therefore, new wire must be continuously supplied. The wire is sold on a bobbin, so that it can be continuously supplied during EDM.



(i) Cutted Drill bit by WIRE CUT EDM-used for AA6085



(j) Cutted Drill bit by WIRE CUT EDM-used for SS316L

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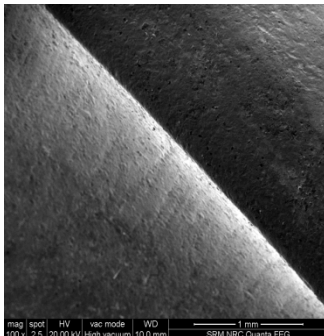
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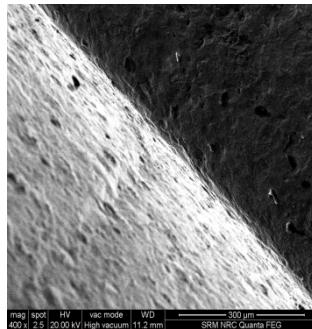
SEM IMAGE TESTING

Scanning Electron Microscopy (SEM), also known as SEM analysis or SEM microscopy, is used very effectively in microanalysis and failure analysis of solid inorganic materials. Scanning electron microscopy is performed at high magnifications, generates high-resolution images and precisely measures very small features and objects. Laboratory Testing Inc. near Philadelphia, PA (USA) has a complete system which also offers Energy Dispersive X-ray Spectroscopy (EDS) capabilities.

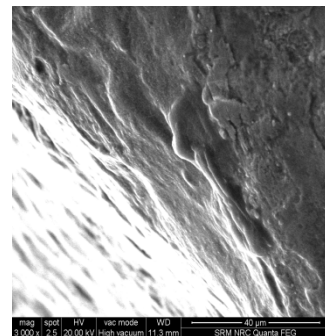
III. RESULTS



(1)

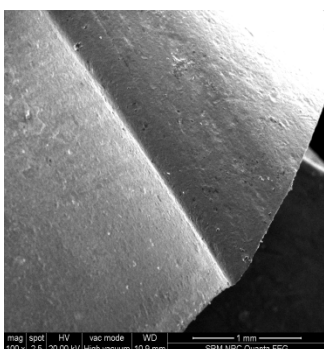


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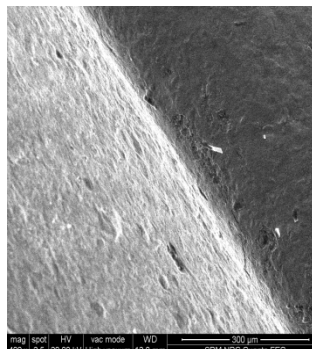


(3)

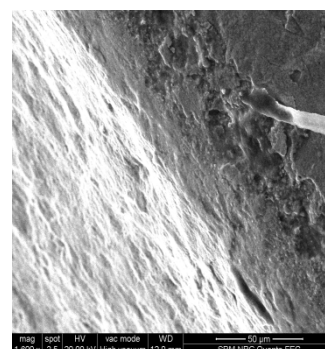
SEM IMAGE TESTING FOR THE DRILL BIT USED FOR AA6085



(1)



(2)



(3)

SEM IMAGE TESTING FOR THE DRILL BIT USED FOR SS316L

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Aluminium Alloy 6085

DEPTH 0.2

avg time:111.33 sec

Speed (in rpm)	132	220	350
Timing (in sec)	126	108	100

DEPTH 0.4

avg time:52.66 sec

Speed (in rpm)	132	220	350
Timing (in sec)	57	53	48

DEPTH 0.6

avg time:42.66 sec

Speed (in rpm)	132	220	350
Timing (in sec)	49	43	36

STAINLESS STEEL SS316L

DEPTH 0.2

avg time:228.33 sec

Speed (in rpm)	132	220	350
Timing (in sec)	252	220	213

DEPTH 0.4

avg time:133 sec

Speed (in rpm)	132	220	350
Timing (in sec)	148	134	117

DEPTH 0.6

avg time:126 sec

Speed (in rpm)	132	220	350
Timing (in sec)	138	135	105

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IV. CONCLUSION

- a) In this project we concluded the optimized machining time and influence of tool wear for the suitable materials.
- b) AA6085 (aluminium alloy) is the suitable for the machining time and tool wear are reduced stage by stage process comparatively SS316L (stainless steel)
- c) The best parameters is to be optimized depth of 0.6mm and average machining time is 42.66secs in the suitable spindle speed of 234rpm.
- d) Comparatively the SEM (scanning electron microscope) results of width 10.33mm is the minimized damage occur in the HSS drill bit used for the material of AA6085.

REFERENCES

- 1) Analysis of Process Parameters in Wire EDM with Stainless Steel Using Single Objective Taguchi Method and Multi Objective Grey Relational Grade. Volume 64, 2013, Pages 868-877
- 2) Process Parameter Optimization of Wire EDM on Aluminum and Mild Steel by Using Taguchi Method . Volume 5, 2014, Pages 2577-2584
- 3) Optimization And Influence Of Process Parameters For Machining With WEDM. Volume. 3, Issue 1, January 201
- 4) Analysis of Tool Wear Rate in Drilling Operation using Scanning Electron Microscope (SEM) volume. 11, No.1, pp.43-54, 2012
- 5) Analysis of Temperature Changes during Dry Drilling of Austenitic Stainless Steels on Twist Drills Having Different Point Angles 2016, 6(5A): 121-125 DOI: 10.5923/c.jmea.201601.23
- 6) Performance Evaluation On Drilling of Austenitic Stainless Steel 316L Using HSS Tool Journal Mechanical December 2014, Volume 37, Issue 2, 18 – 28
- 7) Optimization of Machining Parameters in Drilling of Stainless Steel - Volume 4, Issue 8, August 2015
- 8) Study of some parameters on drilling of Al based Metal Matrix Composites - Volume 3, Issue 7, June-2012