FABRICATION AND WORKING PERFORMANCE ANALYSIS OF DRILL BIT TOOL

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Abstract:
Drilling is cutting technique that involves using drill bit to create or expand circular hole in solid materials. The drill bit is multipoint rotary cutting tool. The bit is pushed against work piece and spun at speeds ranging from hundreds to thousands per minute. As the hole is drilled, the cutting edge is forced against work piece, cutting off chips (swarf).

The purpose of this research is explore influence of process variables such as spindle speed and feed, drill diameter and point angle, and material thickness on thrust force and torque generated during drilling of high HRC material using ansys software. We may utilise three types materials in this thesis: high-speed steel, aluminium silicon carbide, and materials produced with catia v5. As a result, the goal of this study's trepanning tool is to reduce thrust force and torque when drilling HIGH HRC materials. After we've compiled our results, we'll evaluate each material to see which one is the greatest match for drill bit, and then prototype model will be manufactured.

Keywords: silicon carbon; drilling; thrust force; analysis; bearing test.

CHAPTER 1

1. INTRODUCTION:

A drill is tool having cutting tool attachment or driving tool attachment, most often drill bit or driver bit, that is used to bore holes in various materials or connect various materials together using fasteners. A chuck at one end drill grips attachment, which is spun while pushed against target material. The cutting tool's tip, and occasionally its edges, do task cutting into target material. Slicing off thin shavings (twist drills or auger bits), grinding off small particles (oil drilling), crushing and removing work piece fragments (SDS masonry drill), countersinking, counterboring, and other processes are examples.

Woodworking, metalworking, building, do-it-yourself tasks all require drills. Drills with unique designs are also utilised in medical, space missions, other fields. Drills come in wide range performance qualities, including power and capacity. There are several different types drills: some are operated by hand, while others are powered by electricity (electric drill) or compressed air (pneumatic drill). Percussive drills (hammer drills) are often employed in hard materials like masonry (brick, concrete, and stone) or rock. Drilling rigs are used to drill holes in ground for purpose of extracting water or oil. Large drilling rigs are used to drill oil wells, water wells, and holes for geothermal heating. Screws and other fasteners are also driven using several types of hand-held drills. Drills can be used to power some tiny equipment that don't have their own engine, such as small pumps and grinders. A Drilling Machine (also known as pedestal drill, pillar drill, or bench drill) is stationary kind drill that can be installed on stand or fastened to the floor or workbench. The steel work pieces are gripped by portable versions with magnetic basis. A Drilling Machine is made up base, column (or pillar), table, spindle (or quill), drill head, all which are powered by an induction motor. The head features three handles extending from a central hub that, when rotated, move spindle and chuck vertically, parallel to column's axis. A Drilling Machine's size is usually expressed in terms swing. Swing is equal to twice throat distance, which is distance

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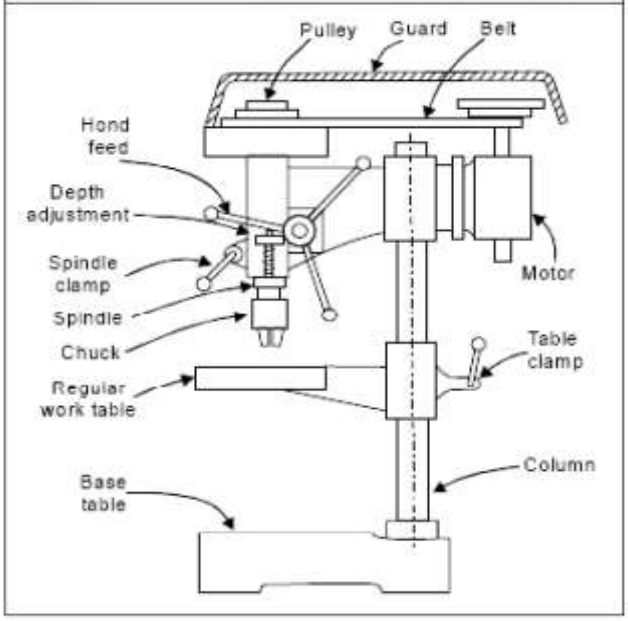
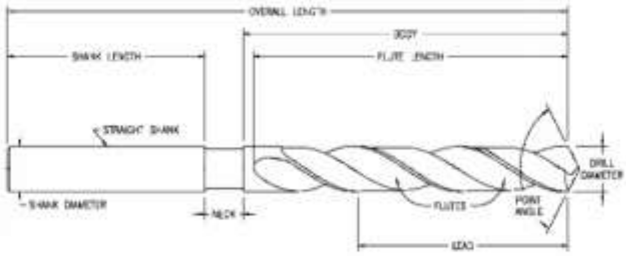
between spindle's centre pillar's nearest edge. For example, 16-inch (410 mm) Drilling Machine has a throat distance of 8 inches (200 mm).

Figure 1: Schematic of Drilling Machine



Drill Bit:
1.2 Anatomy of the drill bits:



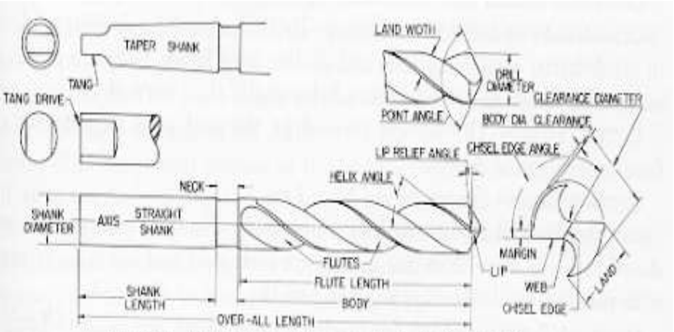
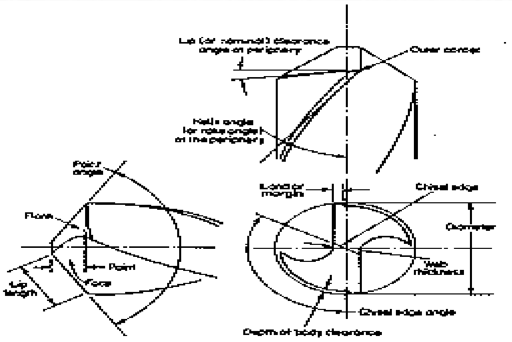


Figure 1—Illustrations of Terms applying to Twist Drills.



This operation is carried out in order to create big holes. While the hole is being made, fewer chips are removed and more material is conserved.

Because the tool's vibration in diameter is restricted by thin cutting edge, it may be used at greater speeds. The drill spindle is shaped like hollow tube with cutting blades on one end solid shank on other. This is one most effective ways to make a hole.

2. Literature Review

Existing depleting mechanical assembly diagram, an exhausting establishment for exhausting either tube moulded or level workpieces has been discovered.

Ismail Ucun and Serder Kaplan et al. (2015) Determination of tool wear and chip production in AISI 1045 material drilling using plasma-nitrided high-speed steel drill bits.

Tool wear and chip formation during drilling of AISI 1045 material with plasma-nitrided high-speed steel drill bits were examined experimentally in this work. The studies employed two drill types: uncoated and plasma-nitrided. The plasma nitriding method was first used on commercial drill bits. Following that, various feed rates and cutting speeds were used in the drilling operation. In the trials, sensitive computer numerical control equipment was employed. SEM microscopy was used to assess tool wear, and chips from the drilling operation were examined under microscope. Finally, statistical analysis was used to evaluate the connection between chip cross section and tool wear. The plasma nitriding technique considerably improves the mechanical characteristics of uncoated high-speed steel drill bits, according to the findings. With the enhancement of the mechanical characteristics, there was less tool wear and better chip formation. There is a link between the chip section and wear, according to the findings.

Ismail Ucun and Serder Kaplan et al. (2015) Determination of tool wear and chip production in AISI 1045 material drilling using plasma-nitrided high-speed steel drill bits.

231(10)DOI:10.1177/0954405415608105 Proceedings of the Institution of Mechanical Engineers Part B Journal of Engineering Manufacture

G. Manoj Reddy, D. Pinakapanireddy, K. Jagdeesh, M. Eswarsai, and Y.V.Hanumantha Raoet al (2019) Drill Bit Finite Element Stress Analysis in Ansys

Drilling is slicing process that uses boring instrument to narrow or widen circular move-location gap in solid materials. A revolving cutting instrument, generally multipoint, is used as boring equipment. The bit is pressed against the painting piece rotated at rates ranging from hundreds to thousands cycles per second. As it's far bored, this powers front line against painting piece, eliminating chipping from gap. With the aid Finite Factor Exam, we are analysing dull instrument. The dull device is immediately shown in Catia, and the same is imported into ANSYS for modular and auxiliary testing current Tungsten carbide device and D2 metallic cloth tool. As result examination, it is clear that when specified conditions are satisfied, D2 metallic material is used instead of cloth to make drill. Within the auxiliary study, recurrence generated by D2 steel drill modular exam is very similar to that tungsten carbide, as same strain, full misshapening, and shear pressure are also apparent concentrated.

G. Manoj Reddy, D. Pinakapanireddy, K. Jagadeesh, M. Eswarsai, and Y.V.Hanumantha Rao et al (2019), International Journal of Innovative Technology and Exploring Engineering (IJITEE), Volume-8 Issue-7, ISSN: 2278-3075

Alok Yadav, Shivani1, and Dr. L.P. Singh

Drill Bit Modeling and Analysis with Various Materials and Others (2019) Bit selection is an essential part drilling optimization process. The choice bit is regarded as crucial aspect of drilling. In this study, we used an HSS twist drill bit as model to compare the outcomes of generating more safe and efficient material from beta titanium alloy andalpha titanium alloy. SOLIDWORKS 2018 is used to model drill bit, and ANSYS WORKBENCH 19.2 is used to do the analysis. Both materials have same geometrical form and input process conditions. The titanium alloy, which is widely utilised in biomedical applications, is being compared to theHSS, which may be employed in wide range of applications. In comparison to the alpha titanium alloy, the beta titanium alloy exhibits the highest effective strain with the lowest equivalent stress, according to the analytical results.

Dr. L.P. Singh and Alok Yadav are Shivani1 and Dr. L.P. Singh are Dr. L.P. Singh and Alok Yadav Drill Bit Modeling and Analysis with Various Materials and Others (2019) www.irjet.net e-ISSN: 2395-0056 www.irjet.net p-ISSN: 2395-0072 Volume: 06 Issue: 08e-ISSN: 2395-0056 www.irjet.net p-ISSN: 2395-0072
Muhriddin and Lazizjon Toshniyozov

3) CATIA

3.1Introduction

CATIA (Computer Aided Three-dimensional Interactive Application) (commonly referred to as /kti/ in English) is a multi-arrange CAD/CAM/CAE business programming package developed by Bernard Charlès' French company Dassault Systems. CATIA is a programming suite developed by Dassault Systems and implemented in the C++ programming language.

Assault Systems' CATIA (Computer Aided Three-dimensional Interactive Application) is a commercial CAD/CAM/CAE software system. Assault Systems' product lifecycle management software suite includes CATIA, which is developed in the C++ programming language.

In the CAD/CAM/CAE industry, CATIA competes with Siemens NX, Pro/E, Autodesk Inventor, and Solid Edge, among others.

3.2 PROCEDURE OF DRAWING ENGINE CYLINDER:

Figure 3.1. selection of plane

Procedure for creating a model.

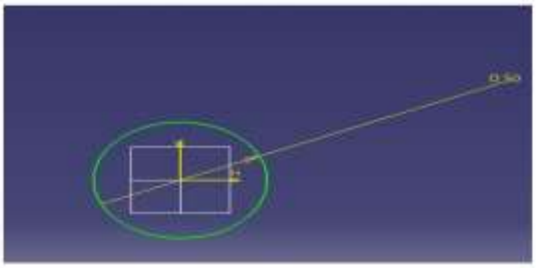


Fig 3.2 Drill bit design

Fig 3.3 Adding the material to circles

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Fig 3.4 Draw the drill bit helix profile

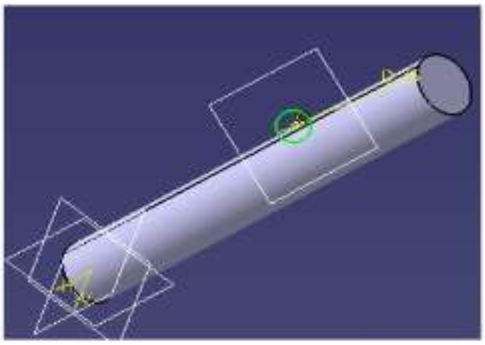
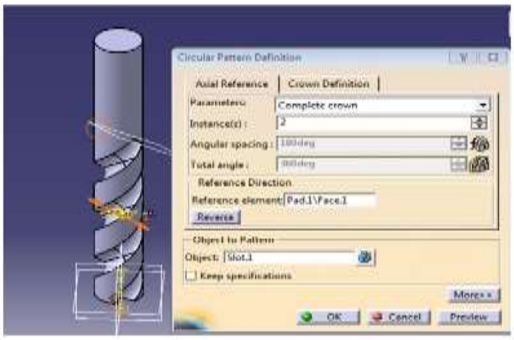


Fig 3.5 Draw the circle to create the drill cutting profile



Circular Pattern Definition

Axial Reference | Crown Definition

Parameters: Complete crown

Instance(s) : 2

Angular spacing : 180deg

Total angle : 360deg

Reference Direction

Reference element: Pad.1\Face.1

Object to Pattern

Object: Slot.1

☐ Keep specifications

Fig 3.6 giving the circular pattern

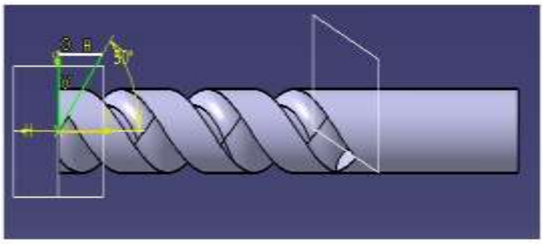
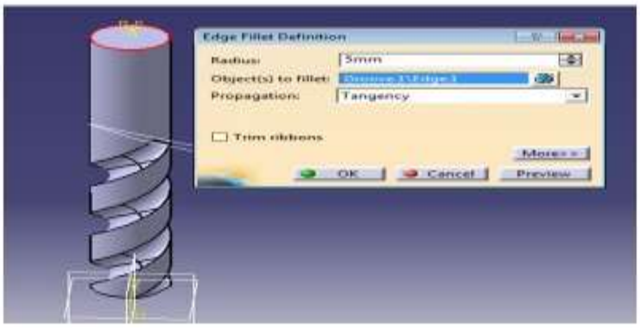


Fig 3.7draw the edge circle



Edge Fillet Definition

Radius: 5mm

Object(s) to fillet: Groove.1\Edge.1

Propagation: Tangency

☐ Trim ribbons

Fig 3.8 edge fillet draw

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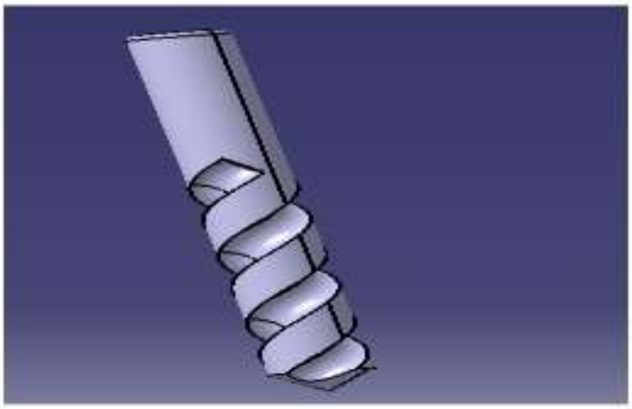

Fig 3.9 Final product of drill bit

Chapter 4

4) INTRODUCTION TO ANSYS:

ANSYS is commercial finite-element analysis software package that may be used to address a wide range of problems. IRIX, Solaris, and Windows NT are among the operating systems that ANSYS supports. Like any other finite-element programme, ANSYS solves governing differential equations by breaking problem down into small chunks. The governing equations of elasticity, fluid flow, heat transfer, and electromagnetism may be solved using the finite element approach in ANSYS. ANSYS can handle both transient and nonlinear problems. The principles of ANSYS will be covered in this article, with a focus on structural examples. ANSYS is installed on all MEnet Sun and SGI machines..

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Project

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Transient
High speed steel
Table **9**
Loads

Object Name	*Fixed Support*	*Moment*	*Remote Force*
State	Fully Defined		
Scope			
Scoping Method	Geometry Selection		
Geometry	1 Face	2 Faces	6 Faces
Coordinate System			Global Coordinate System
X Coordinate			4.7188e-002 m
Y Coordinate			-5.3451e-007 m
Z Coordinate			2.9437e-007 m
Location			Defined
Definition			
Type	Fixed Support	Moment	Remote Force
Suppressed	No		
Define By		Vector	
Magnitude		1. N·m (step applied)	157. N (step applied)
Direction		Defined	
Behavior		Deformable	

FIGURE 1
Moment

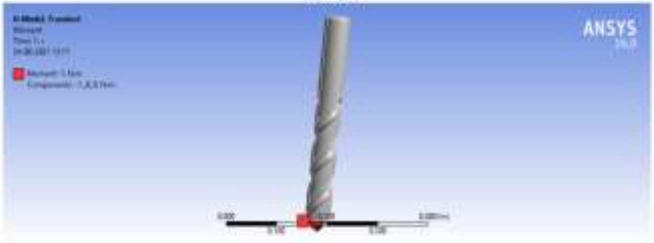

FIGURE 2
Remote Force

Solution

FIGURE 3
Total Deformation

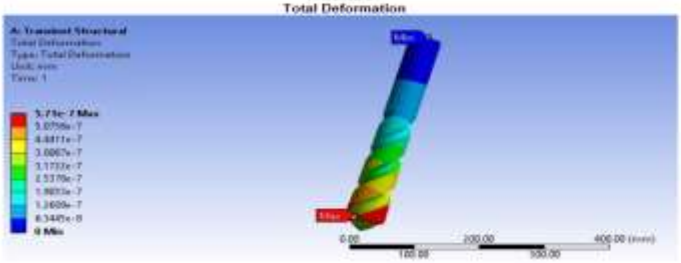

FIGURE 4
Directional Deformation

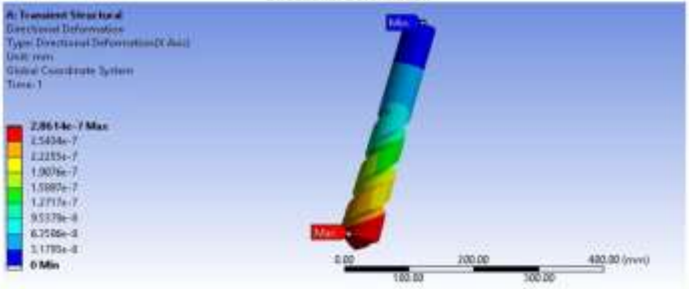

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FIGURE 5
Equivalent Elastic Strain

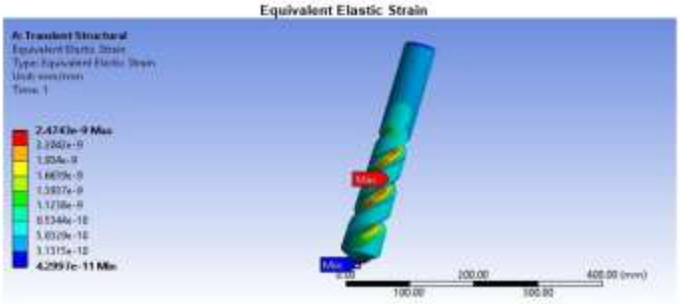


FIGURE 6
Shear Elastic Strain

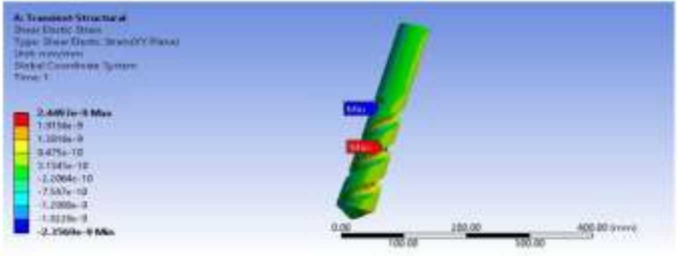


FIGURE 7
Equivalent Stress

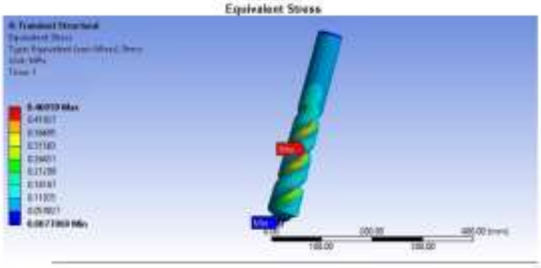


FIGURE 8
Shear Stress

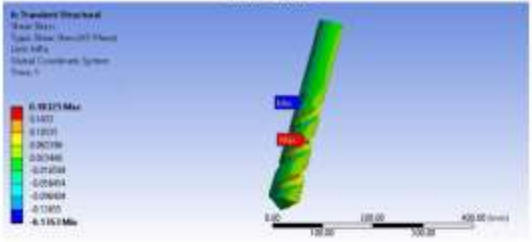


FIGURE 9
Structural Error

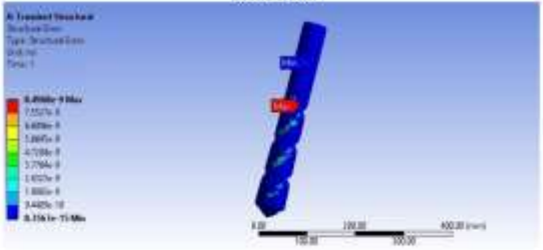
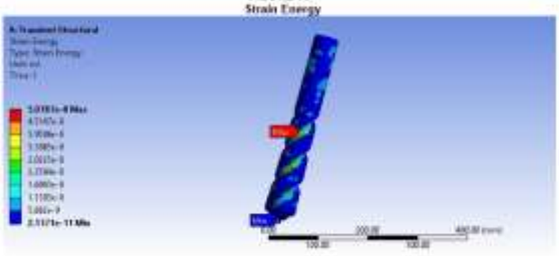


FIGURE 10
Strain Energy



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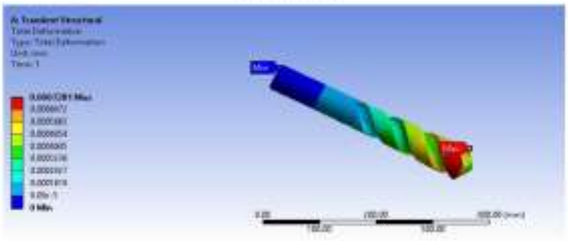
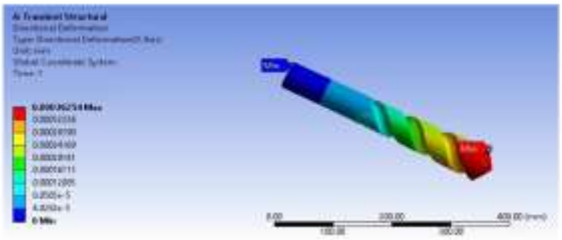
Material:
Silicon Carbide

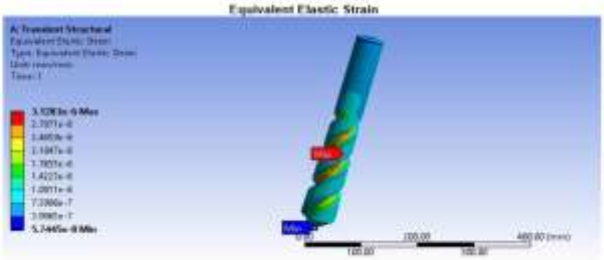
Total Deformation



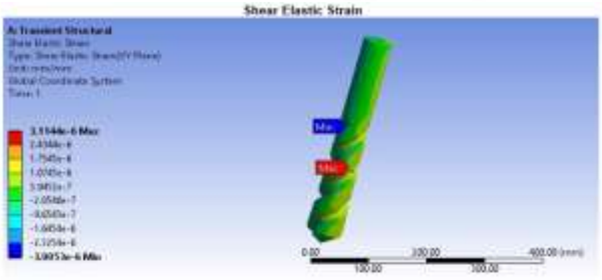
Directional Deformation



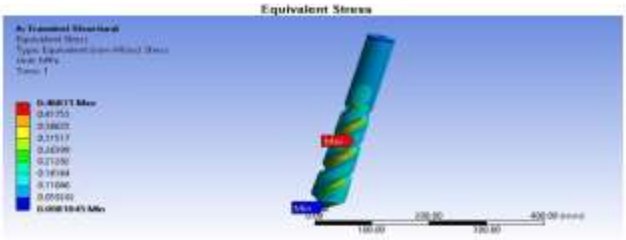
Equivalent Elastic Strain



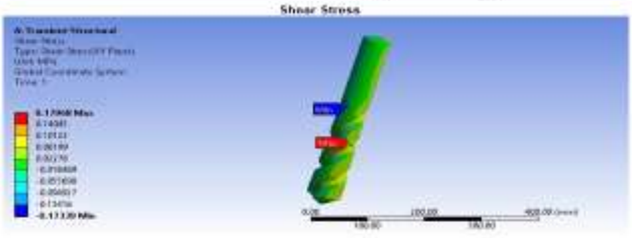
Shear Elastic Strain



Equivalent Stress



Shear Stress



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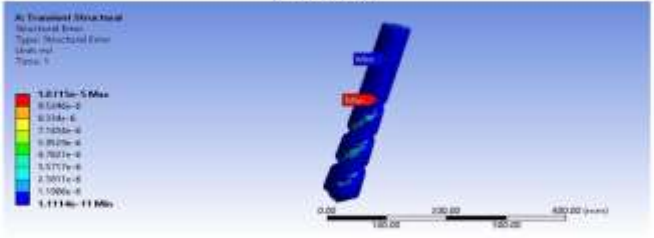
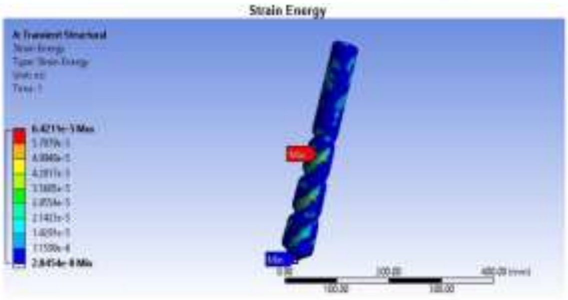
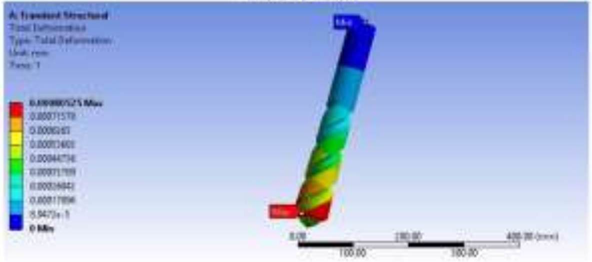
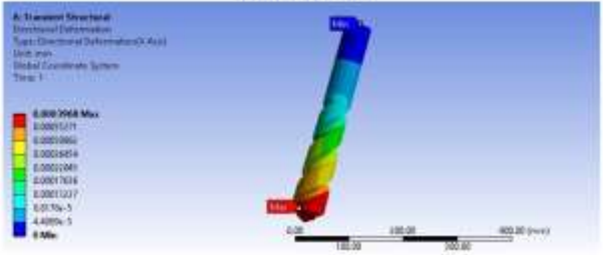

Structural Error

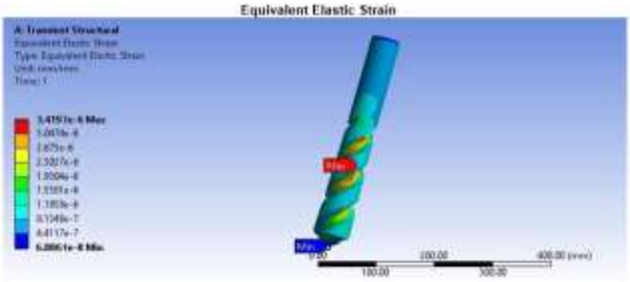

Strain Energy

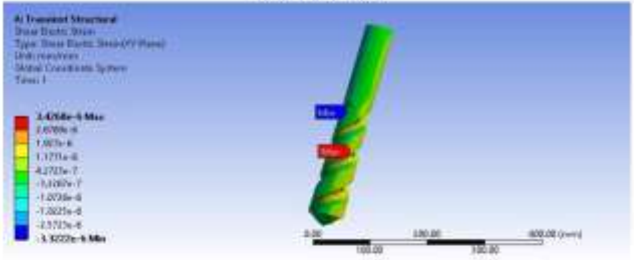
Material:

- **Alsic**


Total Deformation


Directional Deformation


Equivalent Elastic Strain


Shear Elastic Strain

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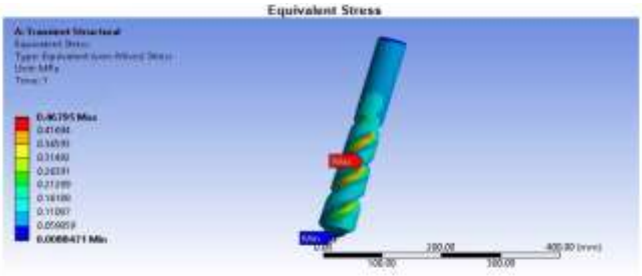
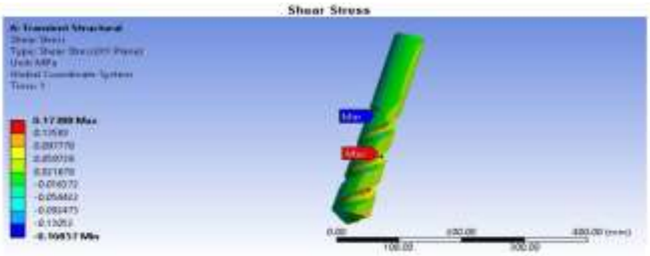
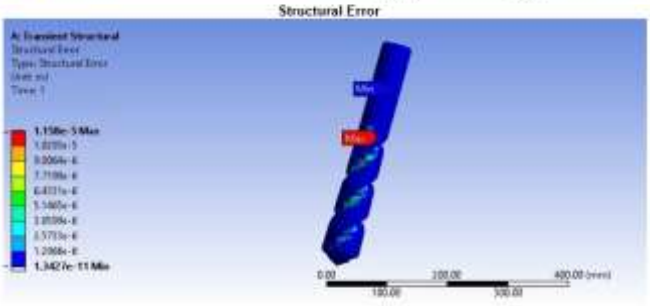
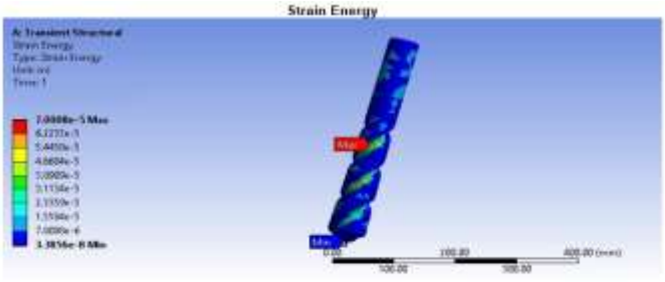
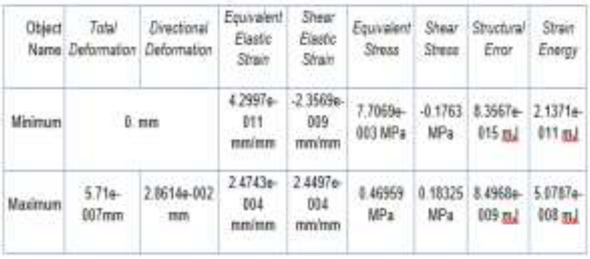






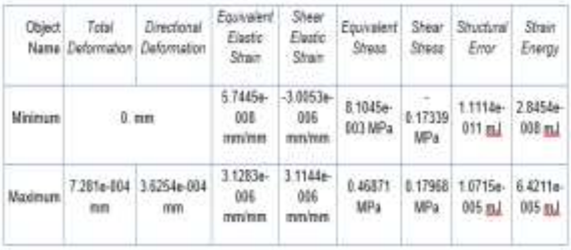


Results:
High speed steel



Object Name	Total Deformation	Directional Deformation	Equivalent Elastic Strain	Shear Elastic Strain	Equivalent Stress	Shear Stress	Structural Error	Strain Energy
Minimum	0. mm		4.2997e-011 mm/mm	-2.3569e-009 mm/mm	7.7069e-003 MPa	-0.1763 MPa	8.3567e-015 mJ	2.1371e-011 mJ
Maximum	5.71e-007mm	2.8614e-002 mm	2.4743e-004 mm/mm	2.4497e-004 mm/mm	0.46959 MPa	0.18325 MPa	8.4968e-009 mJ	5.0787e-008 mJ

Silicon Carbide



Object Name	Total Deformation	Directional Deformation	Equivalent Elastic Strain	Shear Elastic Strain	Equivalent Stress	Shear Stress	Structural Error	Strain Energy
Minimum	0. mm		5.7445e-008 mm/mm	-3.0053e-006 mm/mm	8.1045e-003 MPa	-0.17339 MPa	1.1114e-011 mJ	2.8454e-008 mJ
Maximum	7.281e-004 mm	3.6254e-004 mm	3.1283e-006 mm/mm	3.1144e-006 mm/mm	0.46871 MPa	0.17968 MPa	1.0715e-005 mJ	6.4211e-005 mJ

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Object Name	Total Deformation	Directional Deformation	Equivalent Elastic Strain	Shear Elastic Strain	Equivalent Stress	Shear Stress	Structural Error	Strain Energy
Minimum	0. mm		6.8861e-008 mm/mm	-3.3222e-006 mm/mm	8.8471e-003 MPa	-0.16857 MPa	1.3427e-011 mJ	3.3856e-008 mJ
Maximum	8.0525e-004 mm	3.968e-004 mm	3.4197e-006 mm/mm	3.4268e-006 mm/mm	0.46795 MPa	0.17388 MPa	1.158e-005 mJ	7.0008e-005 mJ

CONCLUSION:

In this post, we looked into drilling of three different materials. Based on our findings, we can infer that project's results were acquired utilising ansys software with correct design and dynamic analysis, and loads were calculated using original drill bit values and design measurements, as well as drill bit design formulae, yielding the following results: When compared to other materials, deformation value aluminium silicon carbide is lower. When compared to other materials, aluminium silicon carbide has lower equivalent stress.

Aluminum Silicon Carbide Materials have greater Equivalent Total Strain than other two materials.

- Aluminium silicon carbide materials exhibit greater Shear Elastic Strain, Equivalent Total Strain, Stress Intensity, and structural inaccuracy when compared to other materials.

Aluminium alloy has greater Equivalent Stress, Shear Elastic Strain, and Tensile Strength than other materials.

Tool Aluminium silicon carbide gave the longest tool life during pecks drilling. As a result, despite their expensive cost, using Aluminum silicon carbide drills is still feasible option to explore because to their high output levels and good hole quality.

REFERENCES:

[1] N. P. Maniar and D. P. Vakharia, IJSER, Volume 4, February-2013, "Plan and Development of Fixture for CNC – Reviews, Practices, and Future Directions."

[2] DjordjeVukelic and JankoHodolic, Adeko, May 18th 2007, "PC assisted instals plan."

[3] "Dance and Fixture Design," Volume 5, February-2014, Hamad Mohammed Abouhenid.

[4] Kiran Valandi, M. Vijaykumar, and Kishore Kumar S, "Improvement, Fabrication, and Analysis of Fixtures," IJIRSET, Vol. 3, No. 4, April 2014.

[5] ShaileshS.Pachbhai and LaukikP.Raut, "A Review on Fixture Design," IJERGS, Volume 2, February-March 2014. PDC.