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Paper Authors

*** V. RAVITEJA, MR. PRANAV RAVINDRANNAIR, MR. B. ANIL KUMAR.**

* Aurora's Technological and Research Institute.

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DESIGN AND ANALYSIS OF DRILL BIT TOOLS USING COMPOSITE MATERIALS

[1]V. RAVITEJA, [2] MR. PRANAV RAVINDRANNAIR, [3] MR. B. ANIL KUMAR
[1]PG Scholar, Advanced Manufacturing Systems, Aurora's Technological and Research Institute, Parvathapur, Uppal, Hyderabad-500098.
[2]Assistant Professor, Aurora's Technological and Research Institute, Parvathapur, Uppal, Hyderabad-500098.
[3]HOD, Mechanical Engineering, Aurora's Technological and Research Institute, Parvathapur, Uppal, Hyderabad-500098.

ABSTRACT:

Drill bits are cutting tools used to remove material to create holes, almost always of circular cross-section. Drill bits come in many sizes and shape and can create different kinds of holes in many different materials. In order to create holes drill bits are attached to a drill, which powers them to cut through the work piecemany different materials are used for or on drill bits, depending on the required application. Many hard materials, such as carbides, are much more brittle than steel, and are far more subject to breaking,

The objective of the present work is to analyze the effect of process parameters 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. 3d model done with the help of catia v5 has been found out using the integration of design calculations in this thesis we can take 3 type of materials like high speed steel, aluuminium silicon carbide, silicon carbide materials. so in this Investigation the trepanning tool is to reduce the thrust force and torque during drilling HIGH HRC materials. After finalizing the results we can comparing the each material and conclude which is better suitable for the drill bit that one will go to machining process to done the proto type model.

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

CHAPTER 1

1. INTRODUCTION:

Bores are cutting mechanical assemblies used to empty material to make openings, frequently of round cross-territory. Exhausting devices come in numerous sizes and shape and can make different kinds of holes in an extensive variety of materials. With a particular true objective to make openings exhausts are joined to an infiltrate, which powers them to cut through the work piece, generally by rotate. The drag will understand the upper end of a bit called the shank in the hurl.

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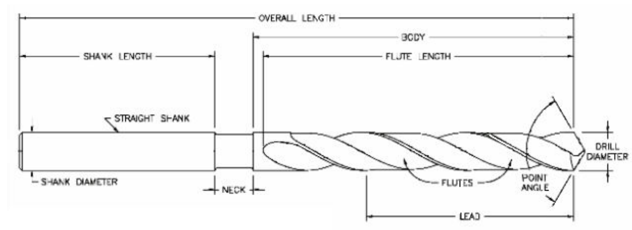
Exhausting contraption come in standard sizes, portrayed in the exhausting device sizes article. An intensive exhausting apparatus and tap assess outline records metric and superb estimated exhausts adjacent the required screw tap sizes. There are in like manner beyond any doubt concentrated exhausting instruments that can make openings with a non-round cross-territory.

While the term enter may insinuate either an exhausting machine or an exhausting instrument for use in an exhausting machine. In this article, for clarity, exhausting apparatus or bit is used all through to imply a bit for use in an entering machine, and bore suggests reliably to an exhausting machine.

1.1 Drill bit working applications:

The winding (or rate of twist) in the drag controls the rate of chip departure. A brisk twisting (high distort rate or "limited woodwind") exhausting mechanical assembly is used as a piece of high manage rate applications under low pivot speeds, where clearing of an immense volume of chips is required. Low twisting (low turn rate or "protracted woodwind") exhausting mechanical assembly are used as a piece of cutting applications where high cutting rates are by and large used, and where the material has a tendency to rankle on the bit or for the most part stop up the opening, for instance, aluminum or copper.

1.2 Anatomy of the drill bits:



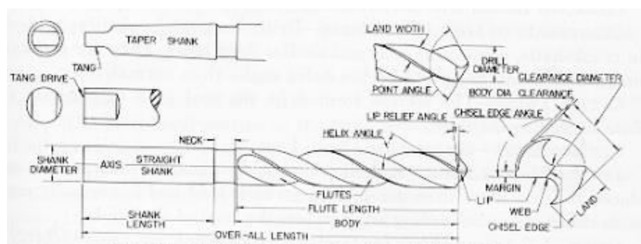
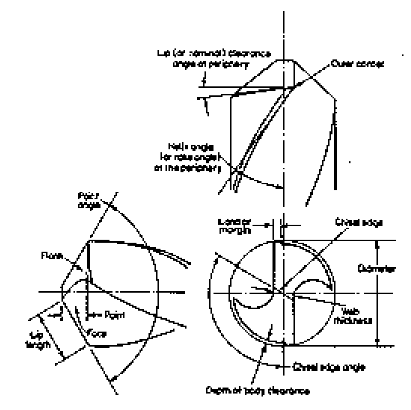


Figure 1—Illustrations of Terms applying to Twist Drills.



1.3 Process Parameters:

Depth of cut: The profundity of the opening produced by the boring procedure

Feed: The rate that the penetrate propels into the material, for the most part estimated in remove per woodwind

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Speed: The cutting pace is typically estimated at the outskirts of the bore in surface feet or meters every moment

Thrust: The pivotal power required to penetrate

Torque: The contorting minute required to bore

Surface Finish: The harshness of the dividers of the bored opening; a measure of the gap quality

1.4 Materials:

- Carbon Steel -
- High Speed Steel (HSS) -
- Cobalt Steel -
- Tool Steel w/ Carbide Tips -
- Solid Carbide –

- **Material Data**
  - **High speed steel**

Density	Young's Modulus MPa	Poisson's Ratio	Bulk Modulus MPa	Shear Modulus MPa
8.16e-006 kg mm^-3	1.9e+008	0.27	1.3768e+008	7.4803e+007

Silicon carbide:

Density	Young's Modulus MPa	Poisson's Ratio	Bulk Modulus MPa	Shear Modulus MPa
4.36e-006 kg mm^-3	1.37e+005	0.35	1.5222e+005	50741

Aluminum silicon carbide

Density	Young's Modulus MPa	Poisson's Ratio	Bulk Modulus MPa	Shear Modulus MPa
2.81e-015 kg mm^-3	1.5e+005	0.3	1.25e+005	57692

CHAPTER 2

Literature Review

Existing mechanical assembly diagram for exhausting An exhausting establishment for exhausting either tube molded or level workpieces onor higgledy piggledy is uncovered.

- The establishment consolidates a base having v-shapedgroove for getting greater tube formed workpieces, a few more diminutive vshaped openings in the side dividers of the base for

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tolerating smaller cy-lindrical workpieces, a cover joined to the base and a rotatable, list competent infiltrate bushing mounted to the cover.

- This creation relates to a drilling establishment for exact arranging ofdrill bits and control of the bearing in the midst of round and empty shaped surfaceseither on or upside down. The entering establishment finds the exhausting devices preciselywith the spot to be exhausted, keeps up the drag around there withoutwondering in the midst of the exhausting activity atmosphere exhausting the twisted orflat surfaces and keeps up the game plan of bore all through the drag ing task [2].
- A gadget is used for coordinating and ensuring the correct position for cross infiltrating in a bar. Furthermore gadget will fill in as various sorts ofwork holders or instrument holders. The gadget is a strong shape with chamfered cornersthat outline eighteen sided symmetrical polygon. Each side has boredholes in that engineered in a fitting size and region to permit thetool to be used for its numerous limits.
- This device include a one piece, reliably square metal 3D square having all corners chamfered at a 45 degree point to give each cornerwith level surface to yield a 18 sided symmetrical polygon. Seventeenof the side outfitted with penetrated openings of different sizes with each holeconcentric and parallel to within line of two converse and parallelsurface of the strong shape [3].

Chapter 3

Modelling:

CATIA (Computer Aided Three-dimensional Interactive Application) (in English typically articulated /) is a multi-stage CAD/CAM/CAE business programming suite created by the French organization Dassault Systems coordinated by Bernard Charles. Written in the C++ programming dialect, CATIA is the foundation of the Dassault Systems programming suite.

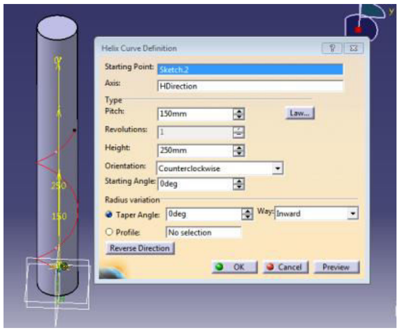

FIG 3.1 Draw the circle to create the drill cutting profile:

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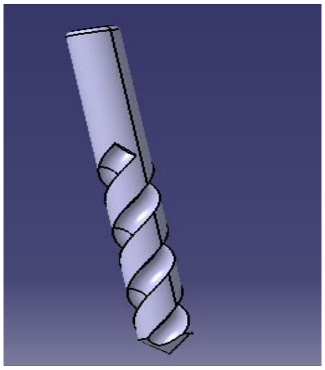


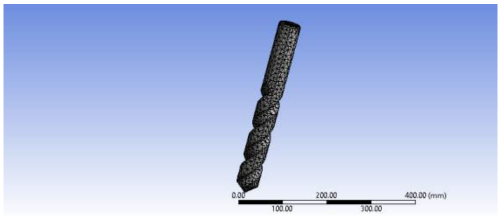
FIG 3.2 final product of drill bit

CHAPTER 4

ANSYS is general-purpose finite element analysis software, which enables engineers to perform the following tasks:

1. Build computer models or transfer CAD model of structures, products, components or systems
2. Apply operating loads or other design performance conditions.
3. Study the physical responses such as stress levels, temperatures distributions or the impact of electromagnetic fields.
4. Optimize a design early in the development process to reduce production costs.
5. A typical ANSYS analysis has three distinct steps.
6. Pre Processor (Build the Model).

Mesh:

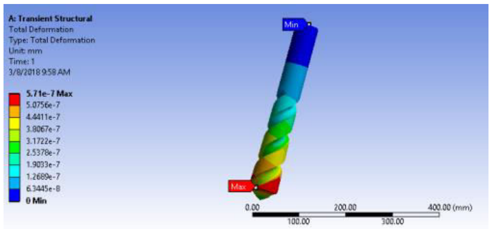


High speed steel

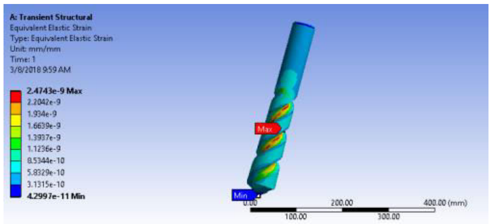
Results:

Object Name	Total Deformation	Directional Deformation	Equivalent Elastic Strain	Shear Elastic Strain	Equivalent Stress	Shear Stress
Minimum	0. mm		4.2997e-011 mm/mm	-2.3569e-009 mm/mm	7.7069e-003 MPa	-0.1763 MPa
Maximum	5.71e-002 mm	2.8614e-002 mm	2.4743e-004mm/mm	2.4497e-004 mm/mm	0.46959 MPa	0.18325 MPa

Total Deformation



Equivalent Elastic Strain



Equivalent Stress

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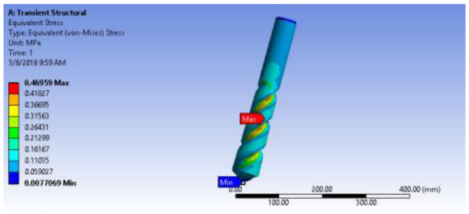
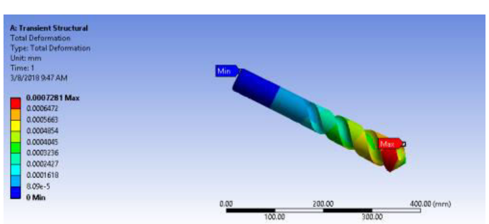


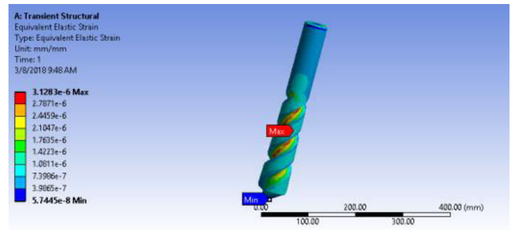
Silicon carbide:

Object Name	Total Deformation	Directional Deformation	Equivalent Elastic Strain	Shear Elastic Strain	Equivalent Stress	Shear Stress
Minimum	0. mm		5.7445e-008 mm/mm	-3.0053e-006 mm/mm	8.1045e-003 MPa	-0.17339 MPa
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

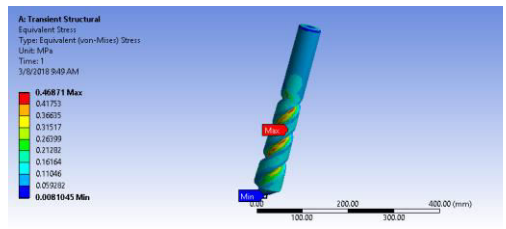
Total Deformation



Equivalent Elastic Strain



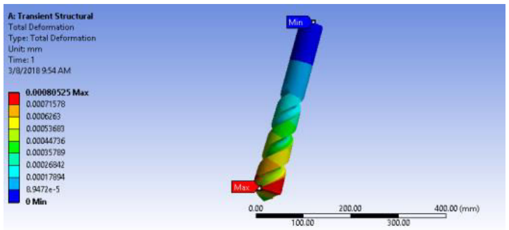
Equivalent Stress



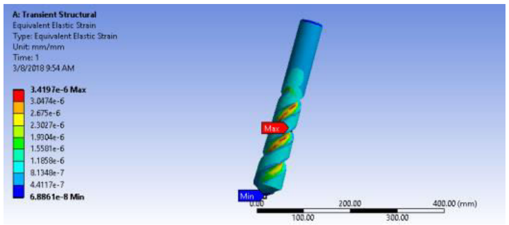
- **Aluminum silicon carbide:**

-	*Total Deformation*	*Directional Deformation*	*Equivalent Elastic Strain*	*Shear Elastic Strain*	*Equivalent Stress*	*Shear Stress*
Minimum	0. mm		6.8861e-008 mm/mm	-3.3222e-006 mm/mm	8.8471e-003 MPa	-0.16857 MPa
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

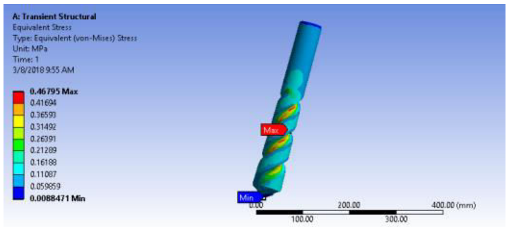
Total Deformation



Equivalent Elastic Strain



Equivalent Stress



Casting process:

Casting is a manufacturing process in which a liquid material is usually poured into a mold, which contains a hollow cavity of the desired shape, and then allowed to solidify. The solidified part is also known as a casting, which is ejected or broken out of the mold to complete the process. Casting materials are usually metals or various cold setting materials that cure after mixing two or more components together; examples are epoxy, concrete, plaster and clay. Casting is most often used for making complex shapes that would be otherwise difficult or uneconomical to make by other methods.

Tooling Required

To produce a crankshaft there are few main tools required:

1) **Lathe machine** – this machine is mainly used when manufacturing billet connecting rod as it requires heavy machining.

2) **Shaper** – to shape, oil lubrication paths

3) **Precision Drills** - to create hole to make sure oil goes through the connecting rod to keep it lubricated, so to cool.

4) Milling machine – a part of machining process to finalise/shape the connecting rod.

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CONCLUSION

In this paper, we conducted a research on the drilling of 3 different materials. Based on our results, we can conclude that From this project results are obtained from ansys software with accurate design and dynamic analysis and loads are taken from original drill bit values and design measurements also taken drill bit design formulas and above results are observing

* Deformation value is less in aluminum silicon carbide comparing with existing material
* Equivalent Stress are least in Aluminum silicon carbide materials comparing with other two materials
* Equivalent Total Strain is more in Aluminium silicon carbide materials comparing with other two materials
* Comparing with existing material Aluminum silicon carbide materials is more in Shear Elastic Strain, Equivalent Total Strain, Stress Intensity, and better in structural error.
* Comparing with existing material aluminum alloy is more in Equivalent Stress, Shear Elastic Strain,

Tool Aluminum silicon carbide gave the best tool life performance during pecks drilling. Therefore, Despite the fact that Aluminum silicon carbide drills are quite
expensive, using them is still an option worth considering due to their high productivity levels as well as their excellent hole quality that we have observed.

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