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Experimental Testing and Performance Analysis of Drill Bit Tool Using High HRC Materials

R Jaya Raghavendra[1], K Srinivasa Rao[2]
M.Tech Student[1],Associate Professor[2], Department of Mechanical Engineering, Mallareddy Engineering College, Hyderabad, Telangana, India[1,2].
Email: jayaraghavendr143@gmail.com[1], srinivas7727@gmail.com[2]

Abstract: Boring apparatus are slicing devices used to evacuate material to make gaps, quite often of roundabout cross-segment. Boring apparatus come in numerous sizes and shape and can make different kinds of openings in an extensive variety of materials. Keeping in mind the end goal to make gaps boring tools are joined to a bore, which powers them to slice through the work piece many diverse materials are utilized for or on bores, contingent upon the required application. Numerous hard materials, for example, carbides, are substantially more fragile than steel, and are unmistakably subject to breaking.The target of the present work is to investigate the impact of process parameters, for example, shaft speed and feed, penetrate width and point edge, and material thickness on push power and torque produced amid boring of high HRC material utilizing ansys programming. 3d display finished with the assistance of CATIA V5 has been discovered utilizing the coordination of plan counts in this proposition we can take 3 kind of materials like rapid steel, aluminum silicon carbide, silicon carbide materials. so in this Investigation the trepanning device is to decrease the push power and torque amid boring HIGH HRC materials. In the wake of settling the outcomes we can looking at the every material and finish up which is better reasonable for the boring apparatus that one will go to machining procedure to done and go for the experimental test.

Keywords: HSS; Aluminum silicon carbide; penetrating; push drive; investigation; Experimental test.

1. OBJECTIVE OF THE WORK

- In this venture work enhancing the quality of the material utilizing the propel composite material.
- Increasing the life and working states of high HRC materials.
- Replacing the composite materials instead of present existing bores.

2. INTRODUCTION

Bores are slicing mechanical gatherings used to purge material to make openings, habitually of round cross-an area. Debilitating gadgets come in various sizes and shape and can make different kinds of openings in a broad assortment of materials. With a specific genuine target to make openings debilitates are joined to an invade, which powers them to slice through the work piece, for the most part by pivot. The drag will comprehend the upper end of a bit called the shank in the heave.

Debilitating contraption come in standard sizes, depicted in the debilitating gadget sizes article. An escalated debilitating mechanical assembly and tap survey layout records metric and brilliant assessed depletes neighboring the required screw tap sizes. There are in like way without question concentrated depleting instruments that can make openings with a non-round cross-an area. While the term enter may intimate either a debilitating machine or a debilitating instrument for use in a debilitating machine. In this article, for lucidity, depleting mechanical assembly or bit is utilized all through to infer a bit for use in an entering machine, and bore recommends dependably to a debilitating machine.

2.1. Drill bit working applications

The winding (or rate of contort) in the drag controls the rate of chip takeoff. An energetic curving (high misshape rate or "restricted woodwind") debilitating mechanical get together is utilized as a bit of high oversee rate applications under low turn speeds, where clearing of an enormous volume of chips is required. Low bending (low turn rate or "extended woodwind") depleting mechanical get together are utilized as a bit of cutting applications where high cutting rates are all around utilized, and where the material tends to annoy on the bit or generally stop up the opening, for example, aluminum or copper.

2.2. Anatomy of the drill bits

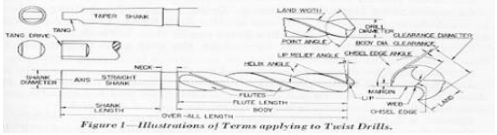

Figure 1—Illustrations of Terms applying to Twist Drills.

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Figure.1. Anatomy of drill bit

2.3. Process parameters

- *Depth of cut:*The significance of the opening created by the exhausting system**.**
- *Feed:*The rate that the infiltrate moves into the material, generally assessed in expel per woodwind.
- *Speed:*The cutting pace is commonly assessed at the edges of the drag in surface feet or meters each minute.
- *Thrust:*The essential power required to infiltrate**.**
- *Torque:*The twisting moment required to exhaust.
- *Surface Finish:*The brutality of the dividers of the exhausted opening; a measure of the hole quality.

3. LITERATURE REVIEW

Existing mechanical gathering outline for debilitating a debilitating foundation for depleting either tube formed or level work pieces on or Willy nilly is revealed.

Nikhil G. Lokhande and C.K. Tembhurkar vol .4 2012) [2].The foundation combines a base having V-shaped groove for getting more prominent tube framed work pieces, a couple of more humble V-formed openings in the side dividers of the base for enduring littler cylindrical work pieces, a cover joined to the base and a rotatable, list skilled penetrate bushing mounted to the cover.

Dhanraj Patel and Rajesh Verma (issn 2278-0149 vol.4, 2015[1]. In this paper to think about the impact of Drilling Tool Material and Forces minor departure from the bored work piece.To assess the Factor of Safety for Different material to investigate the Drilling Tool Life. Along these lines we can upgrade the penetrating powers and instrument geometry by investigation of distortion because of changing in boring device material. At last we can investigate the twisting in boring apparatus geometry and boring device life. • Drilling apparatus geometry • Force on instrument surface • Drilling rate • Minimum amount of grease. • Types of drilling machine.

Kulvinder Garg, Jatinder Singh, Bharat Bhushan (ISSN: 2278-9359(Volume-6,Issue-3 2017) [7].This paper talk about that Drilling is a metal slicing machine process used to make gap of round cross segment by a boring apparatus. The round cross segment openings measure shifting in scope of little to extensive. A few kinds of boring apparatus like H.S.S., carbide instrument, Tin and HSS curve penetrate and so forth are utilized for boring procedure in ventures. The penetrating task is influenced by different information parameters like cutting pace, feed rate, profundity of cut, cutting liquid, bore distance across, point edge and so on. There are different materials like steel, composite material (like C.F.R.P, AL combination), and MMC being utilized for investigation of boring activity.

Kiran Valandi, M.Vijaykumar, Kishore Kumar S, Change (IJIRSET, Vol. 3, April 2014) [4].This gadget incorporate a one piece, dependably square metal 3D square having all corners chamfered at a 45 degree point to give each corner with level surface to yield a 18 sided symmetrical polygon. Seventeen of the side furnished with entered openings of various sizes with each hole concentric and parallel to inside line of two speak and parallel surface of the solid shape.

Rohan R. Gange, Dewang A. Panchal, Saurabh B. (Vol. 4, Issue 03, 2016 | ISSN : 2321-0613) [3].This paper talked about. The Basic Operation of the apparatus is to Hold, Support and simple to find the part which will be machined. This work goes for outlining an installation utilized for performing machining activities on especially a Drill-bit. There are relatively few installations accessible for Drill-Bit at a moderate cost in the present situation. As application for installation configuration varies from industry to industry since measurements required by ventures vary from each other. This straightforward outline of boring apparatus installation get together empowers to perform such activity with precision and repeatability which will dispense with the utilization of exceptionally overrate Fixture and subsequently profiting the organization.

4. COMMONLY USED MATERIALS

- Carbon steel
- High speed steel(HSS)
- Cobalt steel
- Tool steel/carbide tips
- Solid carbide

4.1. Material Data

4.1.1. High speed steel

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

4.1.2. Aluminum silicon carbide

Density	$2.81e^{-006}$ kg mm-3
Young's Modulus	$1.5e^{+005}$ MPa
Poisson's Ratio	0.3

Bulk Modulus	$1.25e^{+005}$ MPa
Shear Modulus	57692 MPa

5. MODELLING IN CATIA V5

CATIA (Computer Aided Three-dimensional Interactive Application) (in English ordinarily explained) is a multi-arrange CAD/CAM/CAE business programming suite made by the French association Dassault Systems facilitated by Bernard Charles. Written in the C++ programming tongue, CATIA is the establishment of the Dassault Systems programming suite.

Figure.2. Draw the circle to create the drill cutting profile

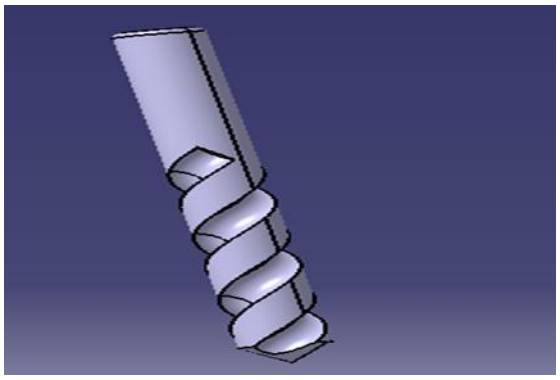


Figure3: Final product of drill bit

6. ANALYSIS OF DRILL BIT USING ANSYS

ANSYS is universally useful limited component examination programming, which empowers designers to play out the accompanying errands:

1. Build PC models or exchange CAD model of structures, items, parts or frameworks.
2. Apply working burdens or other plan execution conditions.
3. Study the physical reactions, for example, feelings of anxiety, temperatures circulations or the effect of electromagnetic fields.
4. Advance a plan right off the bat in the improvement procedure to lessen generation cost.
5. A run of the mill ANSYS investigation has 3 particular advances.
6. Pre Processor (Build the Model).

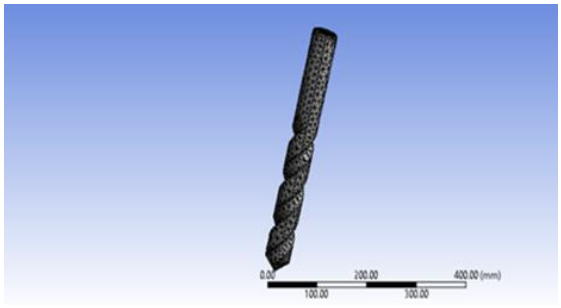


Figure.4. Meshing

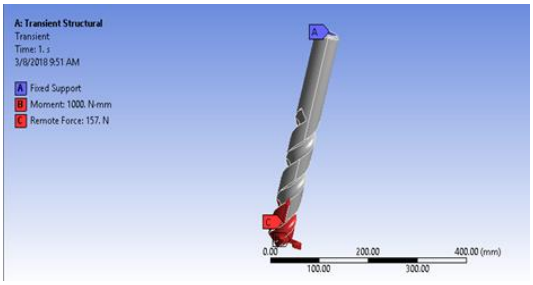
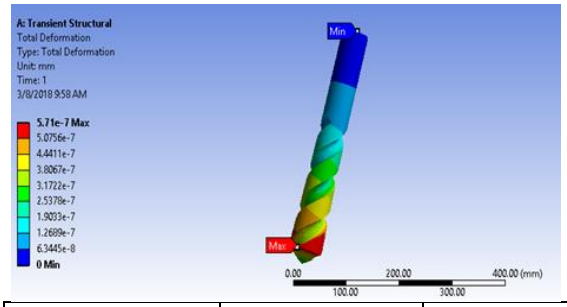


Figure5: Applying force and moment

7. RESULTS

7.1. High speed steel

Object Name	*Minimum*	*Maximum*
Total Deformation	0. mm	$5.71e^{-002}$ mm
Equivalent Elastic Strain	$4.2997e^{-011}$ mm/mm	$2.4743e^{-004}$ mm/mm
Shear Elastic Strain	$-2.3569e^{-009}$ mm/mm	$2.4497e^{-004}$ mm/mm
Equivalent Stress	$7.7069e^{-003}$ MPa	0.46959 MPa



Shear Stress	-0.1763 MPa	0.18325 MPa

Table.1. Ansys results of High speed steel
Figure.6. Total deformation

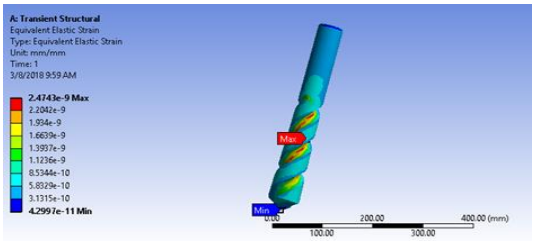


Figure.7. Equivalent Elastic Strain

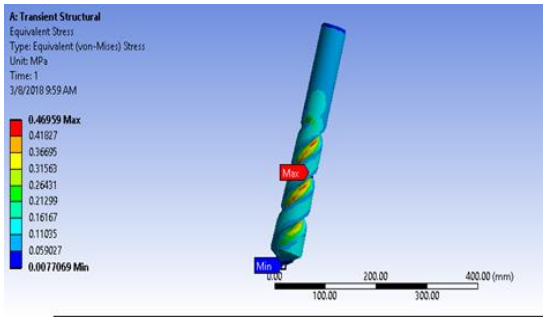


Figure.8. Equivalent Stress

7.2. Aluminum silicon carbide

Object Name	*Minimum*	*Maximum*
Total Deformation	0. mm	8.0525e $^{-002}$ mm
Equivalent Elastic Strain	6.8861e^{-011} mm/mm	3.4197e^{-004}mm/mm
Shear Elastic Strain	-3.3222e^{-009} mm/mm	3.4268e^{-004} mm/mm
Equivalent Stress	8.8471e^{-003} MPa	0.46795 MPa
Shear Stress	-0.16857 MPa	0.17388 MPa

Table.2. Ansys results of Aluminum silicon carbide

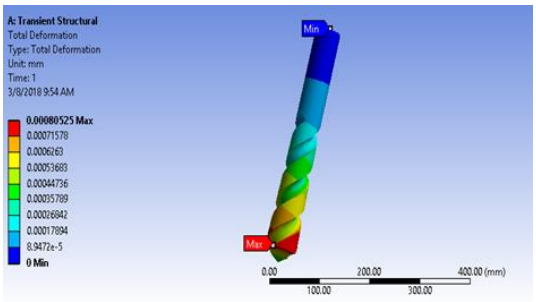


Figure.9. Total deformation

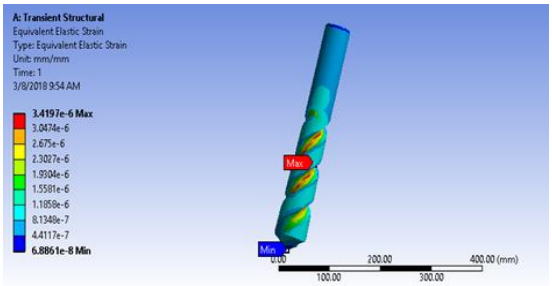


Figure.10. Equivalent Elastic Strain

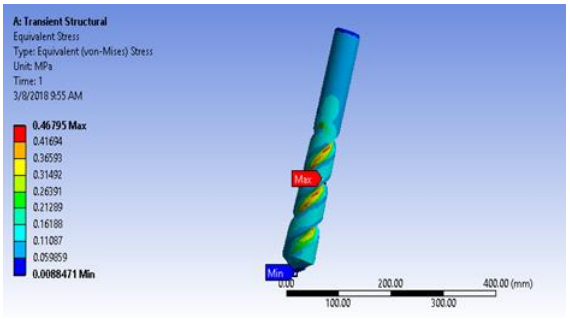


Figure.11. Equivalent Stress

8. CASTING PROCESS

Throwing is an assembling procedure in which a fluid material is normally filled a form, which contains an empty pit of the coveted shape, and after that allowed to bond. The set part is generally called a tossing, which is slung or broken out of the shape to complete the method. Tossing materials are regularly metals or diverse cool setting materials that fix in the wake of combining at least two parts; illustrations are epoxy, solid, mortar and earth. Throwing is frequently utilized for making complex shapes that would be for the most part troublesome or uneconomical to make by different strategies.

Figure.12. Mould Preparation

Figure.13. Removal of Baking sand

Figure.14. Removal of Flash

8.1 Tooling required

To create a boring apparatus there are couple of fundamental instruments required:

- *Lathe machine* – This machine is for the most part utilized when producing boring apparatus as it requires overwhelming machining.
- *Shaper* – To shape, oil ways
- *Precision Drills* - To make opening to material ensure that goes through the boring tool to keep it greased up, so to cool.
- *Milling machine* – A piece of machining procedure to finish/shape the interfacing pole.

Figure.15. Adding coolant in working process

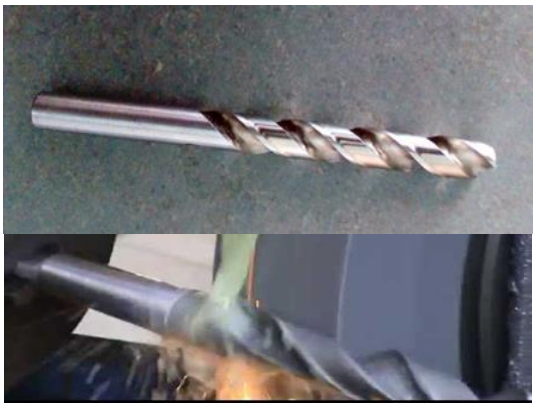
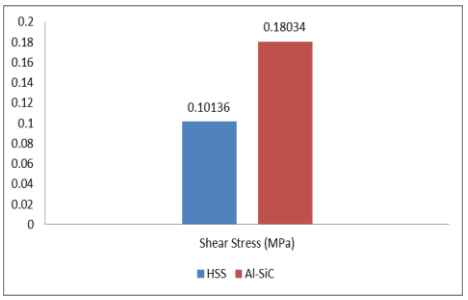


Figure.16. Final product of drill bit with AlSiC



9. EXPERIMENTAL RESULTS

9.1. Impact Test

Observed Values (joules)	*HSS*	*Al-SiC*
Impact 1	14	26
Impact 2	0	0
Impact 3	0	0
Average	14	26

Table.3. Impact test for HSS and AL-SIC

From the above table we have observed that impact test for HSS has 14 joules and AL-SIC has 26 joules. Comparing with both materials AL-SIC is better than the HSS.

Figure.17. Impact test graph for HSS & AL-SIC

From above graph Aluminum silicon carbide (AL-SIC) is more in strength and stiffness on comparing with the existing material (HSS).

9.2 Shear Test

Input data		
Specimen type	Drill involutes	
Specimen diameter	10	
Specimen height	60	
Output data		
	Applied force	Shear Stress
HSS	120 KN	0.10136 MPa
Al-SiC	160 KN	0.18034 MPa

Table.4. Shear test for HSS and AL-SIC

From the above table we have observed that the applied force for HSS is 120 KN and AL-SIC has 160 KN. Compare both materials AL-SIC is better than HSS.

Figure.18. Shear Test Graph For HSS and AL-SIC

Figure.19. Shear Test on HSS

Figure.20. Shear Test on Al-SiC

Figure.21. Impact Test on Al-SiC

Figure.22. Impact Test on HSS

10. CONCLUSION

In this paper, we led an exploration on the boring of 2 distinct materials. In light of our outcomes, we can presume that From this venture results are acquired from ansys programming with exact plan and dynamic examination and burdens are taken from unique boring tool esteems and outline estimations additionally taken boring apparatus plan equations or more outcomes are watching.

- Deformation esteem is less in aluminum silicon carbide contrasting and existing material
- Equivalent Stress are slightest in Aluminum silicon carbide materials contrasting and other two materials
- Equivalent Total Strain is more in Aluminum silicon carbide materials contrasting and other two material
- Comparing with existing material Aluminum silicon carbide materials is more in Shear Elastic Strain, Equivalent Total Strain, Stress Intensity, and better in auxiliary mistake.
- From experimental test, Aluminum silicon carbide (AL-SIC) is more in strength and stiffness on comparing with the existing material (HSS),
- From shear test, Aluminum silicon carbide (AL-SIC) can bear more shear load than the existing material (HSS).

Apparatus Aluminum silicon carbide gave the best instrument life execution amid pecks boring. Consequently, despite the way that Aluminum silicon carbide drills are very.Costly, utilizing them is as yet an alternative worth considering because of their high efficiency levels and additionally their brilliant opening quality that we have watched.

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REFERENCES

[1] Dhanraj Patel and Rajesh Verma-"Investigation Of Drilling Tool Life", (issn 2278-0149 vol.4,2015).

[2] Nikhil G. Lokhande and C.K. Tembhurkar-"Outline of Precise Drilling Fixture and Analysis of Cutting Forces amid Drilling on Cylindrical Surfaces" , vol .4 2012.
[3] Rohan R. Gange, Dewang A. Panchal, Saurabh B. Hande, Akshay C. Gole, Asst. Prof. Ajaykumar S. Ugale-" Design and Analysis of Drill-Bit Fixture", (Vol. 4, Issue 03, 2016) .
[4] Kiran Valandi, M.Vijaykumar, Kishore Kumar S, Change-"Manufacture and Analysis of Fixtures", IJIRSET, Vol. 3, April 2014.
[5] Uwe Heisela, Tobias Pfeifrothb-"Impact of Point Angle on Drill Hole Quality and Machining Forces when Drilling CFRP", (Volume 1, 2012, Pages 471-476)
[6] Miklós Czampaa, Sándor Markosa, Tibor Szalaya "Change of penetrating conceivable outcomes for machining powder metallurgy materials", (Volume 7, 2013, Pages 288-293)
[7] Kulvinder Garg, Jatinder Singh, Bharat Bhushan-"The Process Parameters of Drilling Process"(ISSN: 2278-9359(Volume-6,Issue-3) 2017)
[8] Luis Miguel P. Durão, João Manuel R.S. Tavares, Victor Hugo C. de Albuquerque, Jorge Filipe S. Marques and Oscar N.G. Andrade-"Penetrating Damage in Composite Material" (ISSN 1996-1944, 2014, pg no: 3802-3819).