ISSN No:-2456-2165

Fabrication, Characteristics and Analysis of Drill Bits Made of High HRC Materials

B. Ravi teja[3], B. Ravikumar[2], M. kurminaidu[1]
Department of mechanical engineering, KITS warangal.

Abstract:- Drill bits are cutting tools used to remove material to create holes over a cross-section. Drill bits are brake when they can run at rated speed or rated load of drilling machine [1]. Drill bits are in many sizes and shape and can create different kinds of holes in many different materials. Many hard materials, such as carbides, are much more brittle than steel, and are far more subject to breaking.3D model can design with the help of CATIA V5 R20, this design can analysis in ANSYS [2] software and in this 3type of materials can use, like high-speed steel, aluminium silicon carbide. After analysing the results in ANSYS and those results are comparing with each material and conclude which is better suitable for the drill bit that one will go to machining process to model. Fabrication of twisted drill mix-up with 5-7 percentage of cobalt with high-speed steel and aluminium silicon carbide. To compare the results of both of them, give the better results of twisted drill by wear and hardness of materials.

Keywords:- *drill bit, CATIA, ANSYS.*

I. INTRODUCTION

In case, difficult-to-machine the work-piece materials, such as sintered iron oxide based on powder metallurgy steels, even now researchers can work on developing the drilling process and as well as design parameters of drill bit. For the improve life span of drill bit, because drill bit can used in mass production. To increase life time of tool even little amount, it is more beneficial to industrial applications. Usually, the fabrication technology used for creating a self-lubricant bushing, journal bearing and traction gear etc. But it allows us to prepare a new kind of alloy components, manufacturing of alloys by means of the conventional fabrication process. The material behavior and the enhance of the machining process are completely different from the compare to the conventional processes with the design. some special characteristics are considered to enhance the drill bit by powder metallurgical process. When a drill bit is made by casting a porous elemental structure, a cutting condition known as an intermittent-cutting parameters occurs throughout machining, which significantly increases tool wear. Small chip particles that are always well but can form and become caught in the twist drill's flute. Cutting fluid application is not advised since it can significantly increase corrosion because cutting fluids reside in the surfaces porous structure of the machined material. In-depth research into the machinability attributes is required in order to improve those materials' aforementioned undesirable characteristics. Only a few studies on this subject have been published in the literature. Numerous journal information is available that discuss green machining in mechanical alloying, and that might be a viable way to address machined surface issues.

Abbreviations : HRC-hard Rockwell c type tool tip.
Nomenclature of the HRC drill bits:

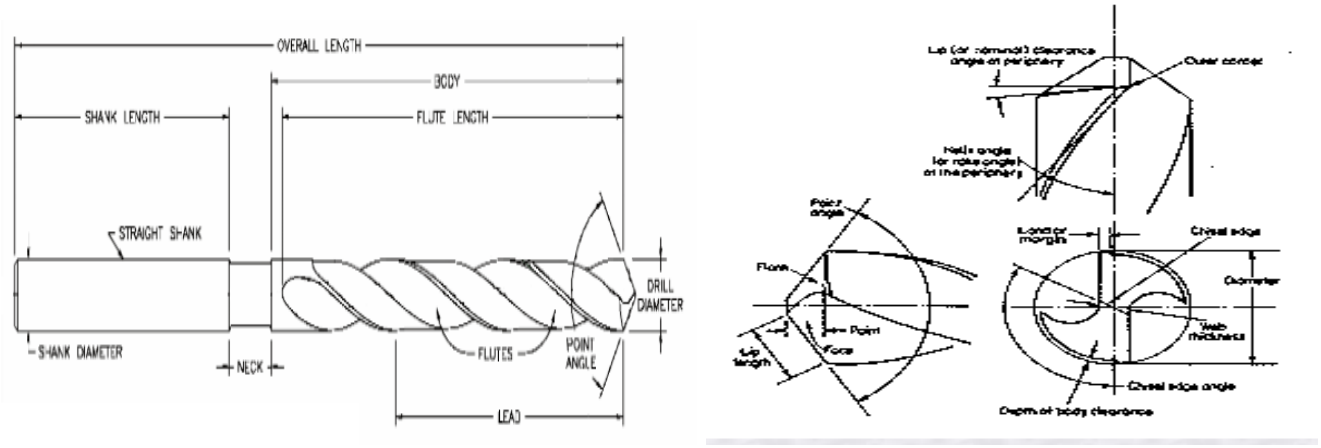

Fig 1: Nomenclature of drill bit

ISSN No:-2456-2165

II. PROCESS PARAMETERS

Depth of cut: The depth of cut is defines the penetration of tool into the workpiece, when the tool do not distorted.
Feed: The rate that the penetrate propels into the material, for the most part estimated in remove material from work-space.
Speed: The cutting space is typically estimated at the outskirts of the drill on surface for every revolution per one second.
Thrust force: The force is exerted normal to cutting force by the drill bit while the machining process.
Torque: torque is defined as the product of tangential force acting on the shaft and radius of shaft.
Surface Finish: The harshness of the dividers of the bored opening; a measure of the gap quality

III. DESIGN OF SPECIMEN ON CATIA

Start the CATIA, Image is arrange on the work region of the system. Twofold tap on image, the item will open. The start-up screen will take after this.

[2] CATIA V5 R20 was the software shape we used to display the spiral pump impeller. The object contains all of the modules that we must complete. Start, File, Edit, View, Insert, Toolbar, Window, and Help will all be demonstrated.[6] We can start a new outline or update an existing one based on your decision.

IV. ANALYSIS OF DRILL BIT IN ANSYS

Analysis of design part in ANSYS imported from CATIA V5R20

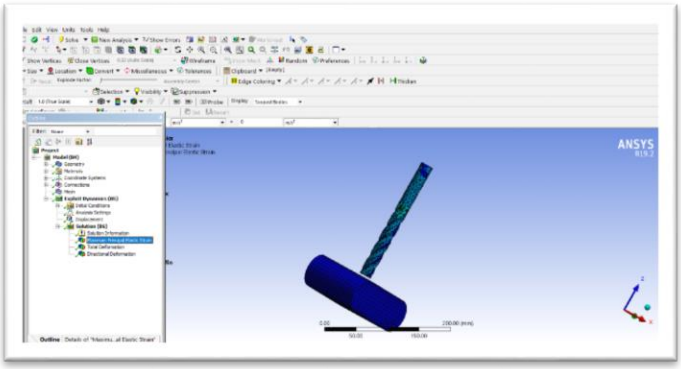

Fig 2: Maximum principal strain in the drill

V. FABRICATION OF DRILL BIT

➢ *Die casting process:*

Die casting is a metal casting method that involves pushing molten metal into a mold chamber under high pressure or gravity fluid force.[5] Because of the metal mold, the same mold may be used to make an endless number of castings, the procedure is also known as Permanent Mold Casting**.**

➢ *Calculation:*

The size of the tool or specimen depends on shrinkage while the solidification of given material.
Volume of drill bit after accomplishment of machining process

Volume(V)=$\boldsymbol{\pi r^2 h}$
$= \pi * (12)\ 2*130,$
$=58810.61\ mm\text{^}2$

Fig 3: fabrication of drill bit by casting process,

ISSN No:-2456-2165

VI. DRILL POINT GRINDER

A equipment called a drill point grinder removes extra material from of the specimen. [9]This device can address the main issue with drilling. Tool tips can be shaped to the desired shape using a grinding machine. There are certain portable grinding machines on the market that can shorten machining times like takeoff and setup. Is appropriate for grinding drills with a diameter of 5 to 40 mm. A lathe machine (figure4)is simple to use and produces drills with improved accuracy and a higher surface polish. It handles every facet of polishing drill points. [4] a fine point that provides excellent accuracy. Precision drill bits provide holes with a superior quality and that are truly round, properly centred, and symmetrical.

Fig 4: machining of drill bit on lathe machine

Fig 5: High speed steel after machining process

Fig 6: aluminium silicon carbide after machining process

VII. RESULTS AND DISCUSSION

Hardness of material

Si no	Force (N)	Diameter (d1=mm)	Diameter (d2=mm)	Vickers number
1	20	3	2.75	4.486
2	30	3.45	3.15	5.107

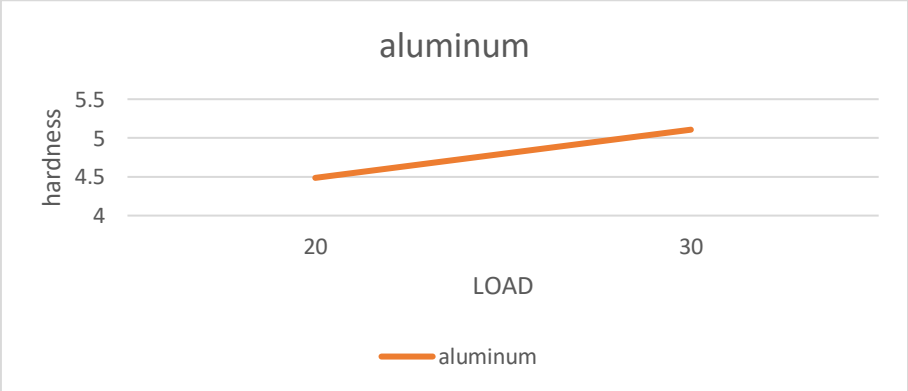

Fig 7: Hardness of aluminum silicon carbide

ISSN No:-2456-2165

Calculation of hardness:

Hardness of materials are calculated by vickers number test
HV= 1.854(force/dia^2).
Where dia^2= area of the indentation.

Si no	Force (N)	Diameter (d1=mm)	Diameter (d2=mm)	Vickers number
1	20	3	2.65	4.623
2	30	3.25	3.20	5.347

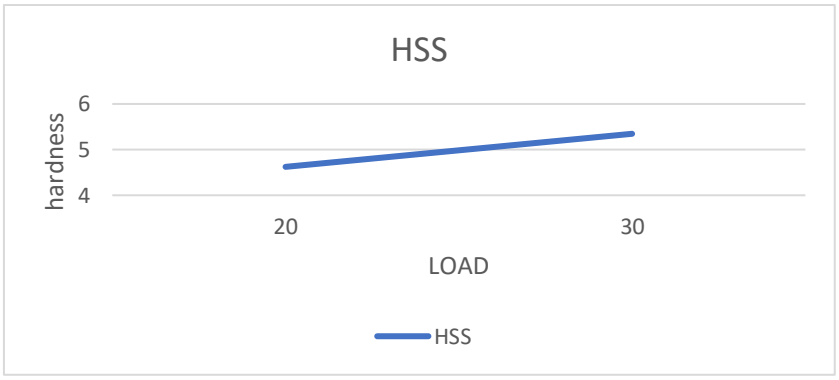

Fig 8: Hardness of high-speed steel

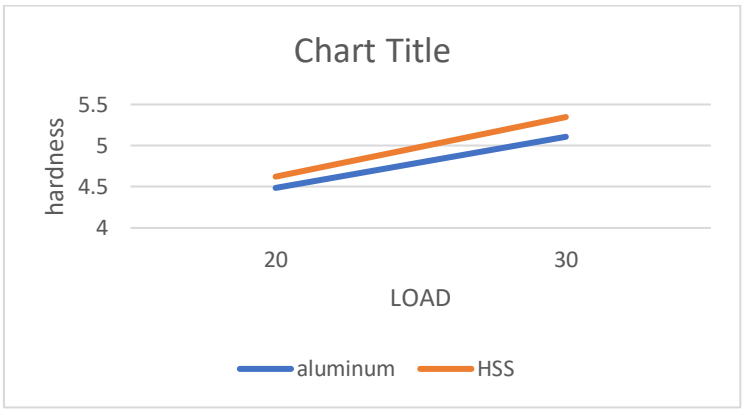

Fig 9: comparison of hardness aluminum silicon carbide with the HSS

Wear rate

High speed steel:

Si no	Load (N)	Time (min)	Speed (RPM)	Sliding distance (m)	Initial weight (grams)	Final wight (grams)
1	10	5	900	1000	17.54	17.51
2	20	5	1000	900	17.51	17.46

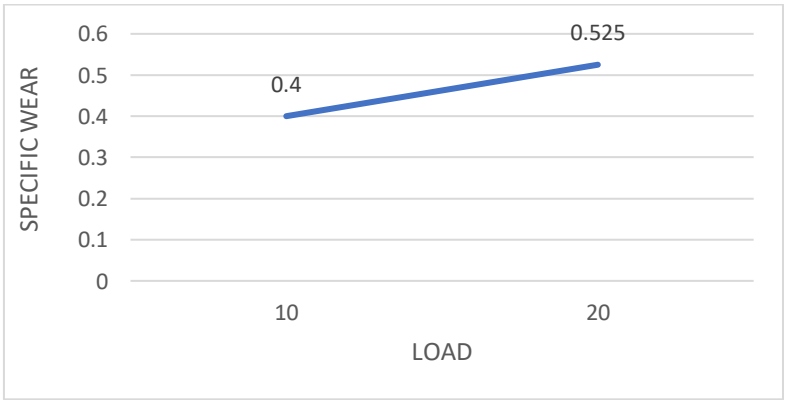

Fig 10: Specific wear rate of high speed steel

Specific wear rate of drill bit:

Si no	Load (N)	Time (min)	Speed (RPM)	Sliding distance (m)	Initial weight (grams)	Final wight (grams)
1	10	5	900	1000	16.67	16.65
2	20	5	1000	900	16.65	16.62

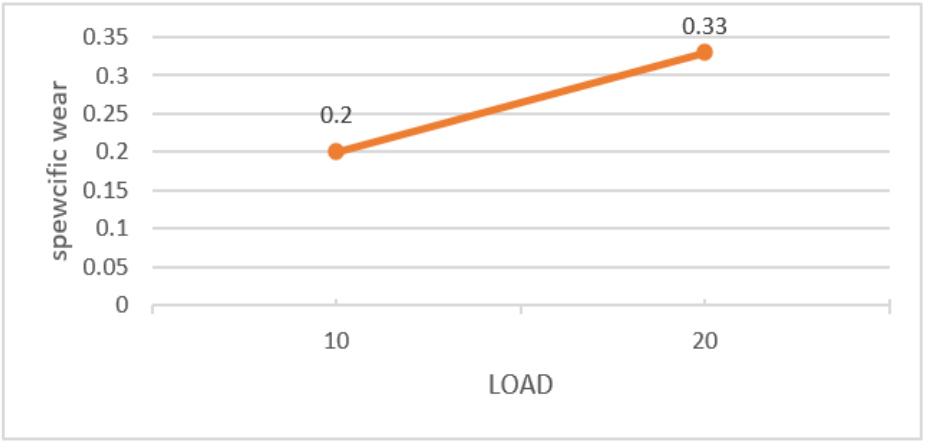

Fig 11: Specific wear rate of aluminum silicon carbide

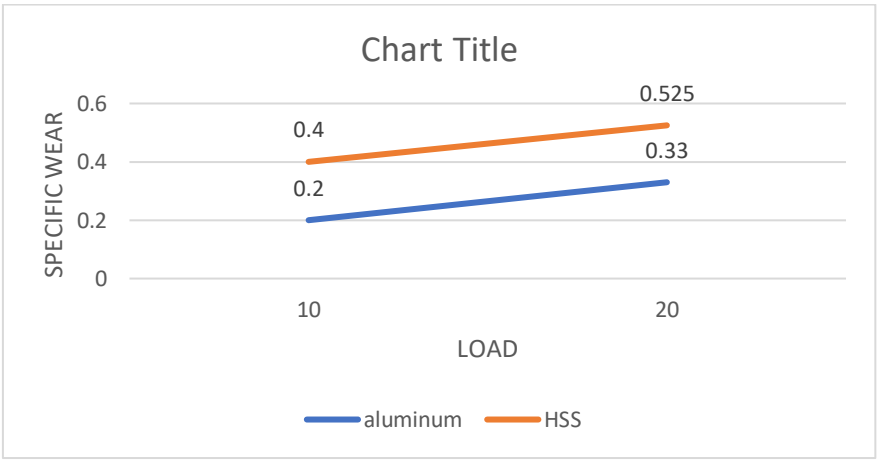

Fig 12: Comparison between aluminum silicon carbide and HSS

The hardest material shows the lowest material remove rate from the specimen. The specimen, which have hard property shows the high compressive strength.

VIII. CONCLUSION

Based on the findings, we can infer that the outcomes of this project were produced using ANSYS software with precise design and dynamic analysis, and loads were calculated using original drill bit values and design measurements, as well as drill bit design formulae. 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. Hardness and specific wear rate of aluminum silicon carbide gives better results compare to the high-speed steel by doing experimental process.

REFERENCES

[1]. Dhanraj Patel and Rajesh Verma (2015) al. ANALYSIS OF DRILLING TOOL LIFE—A REVIEW ISSN 2278 – 0149 www.ijmerr.com Vol. 4, No. 1, January 2015 © 2015 IJMERR.

[2]. Rohan R. Gange Dewang A. Panchal Saurabh B. Hande Akshay C. Gole Asst. Prof. Ajaykumar S. Ugale (2016) al. Design and Analysis of Drill-Bit Fixture IJSRD - International Journal for Scientific Research & Development| Vol. 4, Issue 03, 2016 | ISSN (online): 2321-0613

[3]. Luís Miguel P. Durão 1,*, João Manuel R.S. Tavares 2 , Victor Hugo C. de Albuquerque 3 Drilling Damage in Composite Material (2014) al. Materials 2014, 7, 3802-3819; doi:10.3390/ma7053802 ISSN 1996-1944 www.mdpi.com/journal/materials

[4]. Eremin E.N.a*, Yurov V.M.b, Guchenko S.A.b, Laurynas V.Ch.b, Kasymov S.S.b (2016), Antifriction superhard coatings for drill bits and boring cutters. Eremin E.N.a*, Yurov V.M.b, Guchenko S.A.b, Laurynas V.Ch.b, Kasymov S.S.b (2016), Antifriction superhard coatings for drill bits and boring cutters. 1877-7058 © 2016 Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/). Peer-review under responsibility of the Omsk State Technical University doi: 10.1016/j.proeng.2016.07.663

[5]. F.R. Wong1, S. Sharif 2, K. Kamdani1, E.A. Rahim (2008) al. The Effect of Drill Point Geometry and Drilling Technique on Tool Life when Drilling Titanium Alloy, Ti-6Al-4V Proceedings of International Conference on Mechanical & Manufacturing Engineering (ICME2008), 21– 23 May 2008, Johor Bahru, Malaysia.© Faculty of Mechanical & Manufacturing Engineering, Universiti Tun Hussein Onn Malaysia (UTHM), Malaysia. ISBN: 97–98 – 2963–59–2

[6]. C.C. Tsao a, H. Hocheng b al. (2004) Taguchi analysis of delamination associated with various drill bits in drilling of composite material. International Journal of Machine Tools & Manufacture 44 (2004) 1085–1090 Received 6 October 2003; received in revised form10 February 2004; accepted 26 February 2004

[7]. Kiran Valandi, M.Vijaykumar, Kishore Kumar S, "Change, Fabrication and Analysis of Fixtures", IJIRSET, Vol. 3, April 2014.

[8]. ShaileshS.Pachbhai, LaukikP.Raut, "A Review on Design of Fixtures", IJERGS, Volume 2, Feb-Mar 2014. L. Gerbaud, S. Menand, and Sellami, H., PDC Bits: All Comes From the Cutter Rock Interaction, IADC/SPE Drilling Conference, 2011.

[9]. Ohno, T., Karasawa, H., and Kobayashi, H., Cost Reduction of Polycrystalline Diamond Moderate Bits Through Improved Durability, Geothemics, Vol.31, No.2, 2002, pp. 245-262.

[10]. Barna Szabo, Finite Element Analysis, Canada, John Wiley and Sons Inc, 1991. Recouped from chnology/Structural+Analysis/Explicit+Dynamics, on December 5, 2013.

[11]. Minh, D. N., Geoffroy, H., Bergues, J., and Putot, C., Evaluation of Drilling Parameters of A PDC Bit, International Journal of Rock Mechanics and Mining Sciences, Vol.35, No.4-5, 1998, pp. 578-580.

[12]. Bode D J, Noffke R B and Nickens H V (1989), "Well Control Methods and Practices in Small Diameter Wellbores, SPE 19526", Annual Technical Conference and Exhibition, October 8-11, San Antonio, Tex.

[13]. Bourgoyne A T, Millheim K K, Cheneverert M E and Young F S (1986), Applied Drilling Engineering, Society of Petroleum Engineers, p. 502, Richardson, TX.

[14]. Chur C, Engeser B and Wohlgemuth L (1989), "KTB Pilot Hole, Results and Experiences of One Year Operation".

[15]. Clark G B (1979), "Principles of Rock Drilling, Colorado School of Mines", Quarterly, Vol. 47, No. 2.