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REVIEW ARTICLE

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EXPERIMENTAL AND NUMERICAL ANALYSIS OF THERMAL STRESS STUDIED IN MISMATCH DEVELOP COATED & NON COATED MATERIAL APPLY TURNING TOOL PROCESS: A REVIEW

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ABSTRACT

A hard coating is to improve the presentation of cutting tools in machining applications. Miserably, the development of cutting tool for high-speed machining of hard and difficult-to-cut material has persisted a problem for quality and economy of production. In this current work the performance of multi-layer coated tool in machining of hardened steel (AISI 4340 steel) under high speed turning and compared with that of uncoated tool. Also the soft aluminium and abrasive (Al+5% Si) were turned by using CNC lathe. The influences of cutting parameters (speed, feed, and depth of cut) on cutting forces, surface finish and tool wear have been analysed. Under the different cutting conditions, forces were measured both for coated and uncoated tools. For coated tools the forces obtained of resulted in relatively low values. For comparison, uncoated tool was also tested under the similar cutting conditions. The surface roughness of the work pieces were found out using Taylor Hobson (Surtronic 25) Surface Roughness Tester. Tool wear measurements demonstrate the capability of such tools in turning rigid materials with reasonable tool life. The wear mechanism at the end of tool life was investigated in detail using scanning electron microscope (SEM). It has also been found that the machining of hard materials at higher speeds and lower feeds is improved by using coated tools as compared to uncoated tools. Turning with coated tool is more reasonable than the uncoated in terms of energy and power requirements.

Keywords: Alumina, Coated carbide insert, coating Materials, Titanium carbide, Titanium Nitride and Steel AISI 1018.

INTRODUCTION

In the last decade, the machining of polymer-based composites has been industrialized as an alternative to the injection molding, sintering, or extrusion manufacturing procedures. The manufacturing industry is constantly determined to decrease its cutting costs and increase the quality of the machined parts as the ultimatum for high tolerance manufactured goods is rapidly increasing. The increasing need to increase productivity, to machine more hard materials and to improve quality in high volume by the manufacturing industry has been the driving force behind the development of cutting tool materials [1]. Several cutting tools have been residing continuously since the first cutting tool material appropriate for use in metal cutting, carbon steel, was urbanized a century ago [2]. In this observe, much hard work have been put to proceed its machinability, between which, function of hard coatings on tools by PVD and CVD is individual of the genuine ways. It is proved that coated tool's performance is improved than the uncoated tools. Today about 70% of the tools are cemented carbide coated tools, used in a range of manufacturing industries. In this observe, many exertions have been put to advance its machinability, among which, request of hard coatings on tools by PVD and CVD is one of the effective ways. It is proved that coated tool's performance is enhanced than the uncoated tools. The Al2O3 coated tool produced the second lowest average surface roughness with a reduction of around 23% associated to the uncoated tool. The TiN coated tool formed the third lowest average surface roughness with a reduction of around 7%. While on the other hand, the TiN/Al2O3 coated tool produced the maximum average surface roughness with an increase of around 21%. The surface roughness enlarged while wavering, for all the cutting tools used except for the TiN coated tool in which surface roughness wavered around a constant value and produced more consistent surface roughness that was not pretentious by the flank wear of the tool. This research may be lengthy to revision the effects of multi-layer coatings on cutting tool performance. Multi layers are composed of irregular layers of two different materials that can vary in number from insufficient up to tens of thousands. Multi layers are supposed to offer very elevated strength, hardness, heat resistance, and many new things that could greatly augment the performance of the cutting tools.

LITERATURE REVIEW

Catalin Fetecau, Et Al [2012] Investigated about the PTFE composites are investigated by using a poly crystalline diamond tool in order to examine the effect of the cutting parameters and insert radius on the cutting force and surface roughness. The main cutting force and surface roughness calculated through longitudinal turning were analyzed using the S/N ratio and analysis of variance (ANOVA), and the cutting force and surface roughness with the process variables were derived. [1]

K. Sridhar Et Al [2013] Investigated throughout the finish whirling of aisi 1018 steel beneath dry conditions. The coatings are of al2 o3, tin, tic/ al2 o3/tin and tin/ al2 o3 correspondingly. This study may be extensive to study the property of multi-layer coatings on cutting tool performance. Multi layers are composed of irregular layers of two dissimilar materials that can differ in number from few up to tens of thousands. Multi layers are said to offer very high strength, hardness, heat resistance, and various new property that could greatly improve the performance of the cutting tools. Also this coating technique can be further extended by Nano technology. Nano composite coating offer enormous potential for new applications in industrial areas by insert a coating of Zirconia Toughened Alumina (ZTA). [2]

M. Narasimha [2012] Investigated the analysis is made for the presentation of different coated carbide cutting tool and other tools in machining the steel aisi 1018. The outcome for the machining presentation of the five dissimilar uncoated cutting tools and the coated cutting tool in turning aisi 1018 steel. The uncoated tool of the machined workpiece is initially presented. The results of the other covered tools are then shown and are contrasted to those obtain using the uncoated tool in arranging to obtain the efficiency of the dissimilar coatings on the surface roughness and flank wear. The flank wear and obtained surface roughness outcome for every enclosed tools are

then compared in order to prove the machining presentation ranking of the dissimilar coatings considered. [3]

M. Kaladhar , K. Venkata Subbaiah [2011] Investigated The Influence Of Pressure Vapor Deposition (Pvd) And Chemical Vapor Deposition (Cvd) Coated Cemented Carbide Inserts On The Surface Quality Of The Work Piece When Turning On Aisi 304 Austenitic Stainless Steel Work Pieces, On Computer Numerical Controlled (Cnc) Lathe. Depending on various types of process conditions in work materials surface rough ness can be carried out in many studies. Most of these indicated that a higher depth of cut, and resulting in lower cutting speed and enhance in the surface roughness values. However, the current work did not get such results. The reason is that the surface finish is adversely affected by lower feed rates. The formation of BUE which leads to the feed rate is low, which is partly carried out by the chip and the remaining part is deposited on the work piece . [4]

M.A. Sulaiman et al [2014] Concluded the sandvik uncoated carbide insert, and cngg 120408-sgf-h13a cutting tool was used in the high-speed turning of titanium alloy ti-6al-4v eli (extra-low interstitial) with 32 hrc hardness. Wear is one of the problems that cannot be avoided in machining process.[5]

Jan C. Auricha et al [2012] Investigated about the research for another way coated cemented carbide index able inserts (tin, tin+tialn+tin, tin+ticn+al2o3, tin+ticn+al2o3+tin) and tools of uncoated cemented carbide, are serve as a orientation for the aptitude of the coating systems, are used. [6]

Tugrul ¨ozel [2005] Concluded that the effects of cutting tool edge geometry, work piece hardness and feed rate , cutting speed on surface roughness and resultant forces in the finish hard turning of aisi h13 steel were experimentally investigated. The results have indicated that the effect of cutting edge geometry on the surface roughness is remarkably significant. The cutting forces are influenced not only by cutting conditions but also the cutting edge geometry and work piece surface hardness. This study shows that the effects of work piece hardness, cutting tool edge geometry and feed rate and cutting speed on surface roughness are statistically significant. The edge geometry and the work piece hardness effects of two-factor interactions shown, then the geometry edge and the feed rate, and the cutting speed and feed rate are also appeared to be important.Particularly, honed edge geometry and lower work piece surface hardness resulted in better surface roughness. [7]

M. Dogra [2011] Presented a survey on difference in tool geometry i.e. Tool nose radius, groove on the rake face, variable edge geometry, rake angle ,curvilinear edge and wiper geometry tools and tool wear effect, surface roughness and integrity of the machined surface in the tool surface. In the use of variable micro-geometry design if the focus is given to ratio of uncut chip thickness to edge radius process performance can be enhanced. As with decreasing uncut chip thickness to edge radius ratio friction factor increases. Further the effect of variable micro geometry design should be explored with respect to surface integrity i.e. The residual stresses impact, with white layer formation of micro-hardness variation beneath in the machined surface. [8]

Pm tadvi [2011] offered case study paper. One of the most commonly used metal removal operations in industry. The good surface quality material is used to eliminate material faster by giving a sensible geometrical necessities. [9]

Dr. Abdul kareem jaleel [2013]The present work studies the effect of cutting parameters (cutting speed, feed and depth of cut) in turning method functional on c-60 steel with multi- coated carbide cutting apparatus at elevated cutting speeds. The influence of cutting parameters on a cutting forces, tool wear and surface roughness be analyzed. [10]

Sudhansu ranjan das et al [2013] The effect of machining parameters (feed, depth of cut and cutting speed) on surface roughness parameters (ra and rz) were investigated by applying anova. [11]

Puneet Bansala Lokesh [2012] Invistgated about the materials are difficult to machine because of high hardness and abrasive nature of reinforcing elements like alumina particles. In this study, homogenized (2%, 4%, and 6%) by weight of alumina

aluminum metal matrix .The titanium nitride coated tungsten carbide tool and uncoated tungsten carbide tools were used at different cutting speeds (265,400,535 rpm), investigated. [12]

` Oliver Pecata [2013] Present the continually results in a catastrophic collapse of the tools. In the present study small frequency vibration assist drilling (lfvad) of cfrp/ti6al4v [10/10 mm] was examine in terms of tool wear and calculate to conservative drilling. Solid carbide drills with a diameter of 4.8 mm and unusual cvd and pvd coatings have been erudite. [13]

Christophe Ramireza [2014] The present investigation focuses on the estimation of tool wear and surface integrity in the situation of cfrp cutting. The drilling experiment were performed on the series of cfrp plates by means of cemented carbide solid drills with the aim is to consider correlations between damage in tool, temperature cutting forces,and surface quality hole. [14]

CONCLUSION

This study assess the machining presentation of four commercially obtainable cutting tool and inserts in turning AISI 1018 tool.The uncoated, TiN/Al2O3 coated, TiN coated, TiC/Al2O3/TiN and Al2O3 coated tools are examine and the ensuing machined work piece surface finish were analysed their flank wear . The tool coating were found to advance upon the wear confrontation of the cutting tool. This shown the reduce in wear on the flank face of the covered tools compare the uncoated tool. The wear of the TiN enclosed tool was about 12.2% lesser than the wear observed on the uncoated tool. Decreased TiN/Al2O3 coated tool show around 65% compared to the uncoated tool. The reduce in wear is due to the wear confrontation property of the TiN and Al2O3 materials, the elevated chemical steadiness of the Al2O3 layer and other materials. The Al2O3 coated tool showed a decrease of around 92% compared to the uncoated tool. The improved wear confrontation of the Al2O3 coated tool evaluate to the TiN/Al2O3 coated tool is theoretical to the oxidation of the TiN material and the appear of TiO2 beneath the Al2O3 layer which deteriorate the appearance of theAl2O3 layer. The TiC/Al2O3/TiN coated tool materialize to have the buck wear of all the tools experienced, and show the reduce of approximately 96% in wear evaluate to the uncoated tool. The crate of the machined surface roughness, all the coated tools are created lower surface unevenness than that created by the uncoated tool excepting for the TiN/Al2O3 coated tool and other tools. This was assumed to be due to factor further the coating material are mainly unusual chip breaker geometry tothe tool surface which created longer chips that got in make contact with the work piece material, increased material surface roughness and increase the life of tool. The TiC/Al2O3/TiN coated tool created the buck average surface roughness throughout the 60 cuts with a reduce of around 38% compare to the uncoated tool.

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