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WEAR ANALYSIS TOOL CARBIDE INSERTS DUE TO DRY MACHINING STAINLESS STEEL

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Abstract

Turning is a machining process that aims to shape the material in particular cylindrical. In turning there are a number of problems that arise and may interfere with the process of production, one of which is a tool wear. This research examines the hardness and wear of tools by using tool Al_2O_3 + TiO_2 and tool TiO_2. Experimental method is the method used in this study where rockwell hardness testing use testing and measurement of edge wear toolmaker microscope using a measuring instrument. Stainless steel is the material used in the machining process. Hardness testing results obtained to tool Al_2O_3 + TiO_2 is 87,82 HRC and tool TiO_2 is 87,52 HRC. Measurement of the average flank wear tools Al_2O_3 + TiO_2 is 0,040 VB and tools TiO_2 is 0,016 VB. Cutting speed significant effect on tool wear on turning the results of stainless steel grade 301, depth of cut and feed rate had no significant effect. But simultaneously, all three of these parameters significantly affect tool wear.

Introduction

The increase of science and technology, where it now appears advancement Industrial tooling machines in the country, that is absolutely supported by management industry in particular metal machining field. Wear and tear is generally defined as the progressive loss of material or transfer of a material from a surface as a result of relative movement between the surface to the other surface. Wear and tear is not just a single process, but several different processes that can take place independently or simultaneously. The mechanism is closely related to friction wear.

Cemented carbide is a hard material used extensively as cutting tool material, As well as other industrial applications. It consists of fine particles of carbide cemented into a composite by a binder metal. Cemented carbides commonly use tungsten carbide (WC),titanium carbide(TiC), ortantalum carbide(TaC) as the aggregate. Mentions of "carbide" or "tungsten carbide" in industrial contexts reviews these usually refer to cemented composites. [1,2]

The hardness of the cemented carbide heat (tied up) will only Decrease as softening of the binder elements. The greater the percentage of Co binders, the more violence decreases and the opposite of Increased toughness.In this study, the comparison of hardness and wear of the tool TiO_2 and tool Al_2O_3+TiO_2.

Flank wear can be measured by using a microscope, where the field of eye-piece set so that the optical axis is perpendicular. Long Flank wear can be determined by measuring the length of VB (mm), the distance between the eye-piece before the wear and tear to the median line of wear and tear on the main field. Meanwhile, the crater wear can only be measured using surface roughness measuring instrument. In this case the sensor is shifted to the field furious with the shifting axis parallel to the axis is set so that the field was furious. From the results obtained measuring the maximum depth that the depth of the crater wear expressed by KT (mm) Wear of the edge according to ISO 3685, there are 3 important areas, among others:

- Zone N: This is the depth of cut divided by four.
- Zone C: An area of nose radius.
- Zone B: It is the depth of cut is reduced area C and area N.

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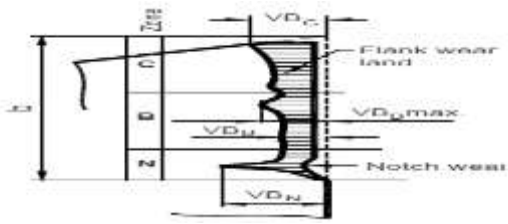

Figure 1 The wear of the edge based on the standard ISO 3685: 1993 [3]

The cause of the wear and tear could be one factor or a combination of several factors. The factors that cause wear and tear among other processes: abrasives, chemicals, adhesion, diffusion, oxidation, plastic deformation, fracture, and fatigue [4,5].

Machining dry or in the world of manufacturing is known for machining the green (green machining) is a way of machining process or cutting metal without the use of coolant but using particles of air as a coolant during the machining process takes place to produce a desired product with a view to reducing production costs. [6,7]

Research Methods

The object of research that will be investigated in this study is the hardness measurement and tool wear due to dry machining stainless steel using experimental methods.

Tools and Test Materials

- Material Objects Work
  Workpiece material used is stainless steel grade 301 with a diameter of Ø38 x 350 mm
- Tools
  Chisel used in this research is in the form of tool TiO_2 and tool $Al_2O_3 + TiO_2$,
- Lathe
  Lathes used in the data collection process lathe tool wear is brand Dragon CM 6241 x 1000/1500 mm
- Stopwatch
  The stopwatch is used to calculate the machining time during the test tool wear, because the tool should be measured every certain period of time.
- Microscope Digital, HD Color CMOS, HS Dsp, 24-bit DSP, OR 2592x1944, 50x DZ
  Toolmaker microscopes used to measure the wear of the tool.

Retrieval Of Data During The Process Of Lathing

1. Preparing dimensions of the workpiece to be used, namely steel stainless steel with a diameter of Ø38 x 350 mm.
2. Setting up the workpiece, tools, lathes, measuring instruments (stopwatches), Vernier Caliper and tool wear test equipment.
3. Set up on a lathe with a cutting speed (v) , feed rate (f) and depth of cut (a). In this process depth of cut is 1,5 mm fixed and tool angle of 60^0, with a variation of the cutting speed of 101,4 mm/min, 109,1 mm/min, 155,3 mm / min, the variation in feeding 0,18 mm/rev , 0,22 mm/rev, 0,28 mm/rev.
4. Installing the workpiece in a lathe spindle and cutting tool on the tool post, set to tool perpendicular to the spindle axis lathe.
5. Testing process with variable slindrik predetermined machining process and record the time of cutting by using a stopwatch to time 10 (min) for each workpiece.
6. Changing the workpiece to the next turning to the variables that have been determined.
7. Stop the lathe, measurement tool wear (wear edges) by using the tool wear test equipment
8. Repeat steps 1-7 for turning process with variable machining process that conformed to the arrangement of testing and measurements carried back edge wear.
9. Perform step 8 until all trials completed

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Results and Discussion

The results of hardness test and tool chemical composition tool TiO_2 and tool Al_2O_3 + TiO_2 indicated in the following :

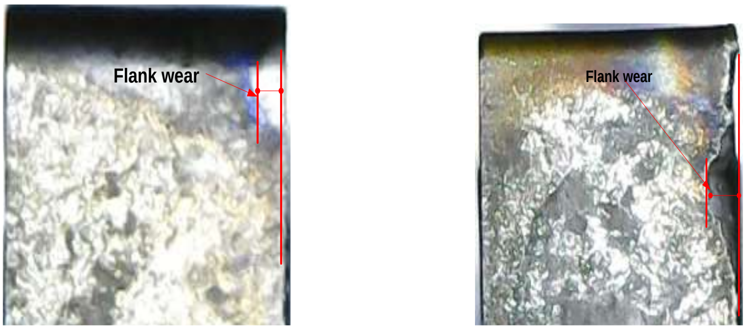
Table-1 Chemical composition tools

Oxide Chemical Composition and Sculpture				
Chisel	Element	Comp. Atom (%)	oxides	wt (%) Oxide
Al_2O_3 + TiO_2	Oxygen	66,67	-	0,00
	titanium	33,33	TiO_2	100,00
TiO_2	Oxygen	66,57	-	-
	Aluminum	0,56	Al_2O_3	1,08
	titanium	32,86	TiO2	98,92

Table-2 Tools hardness

Tools hardness Inserts (HRC)	
Al_2O_3 + TiO_2	TiO_2
87,82	87,52

The results of the analysis obtained tools hardness test tool Al_2O_3 + TiO_2 higher hardness values compared to tool TiO_2, where 87,82 HRC hardness value to tool Al_2O_3 + TiO_2 and 87,52 HRC to tool TiO_2. To determine the dimensions of the wear is required discontinuation of the cutting process so that the cutting tool wear can be measured using a toolmaker microscope.



a. Tool TiO_2 ***b.Tool Al_2O_3 + TiO_2***

Figure-2 Flank wear

The data of the test and measurement flank wear that occurs with variations in cutting speed, feed rade, depth of cut is still shown in the table:

Table -3. Flank wear carbide tools

No.	VC (m / min)	f (mm / rev)	VB (mm)			
			Al_2O_3 + TiO_2	tc (min)	TiO_2	tc (min)
1	101.4	0.18	0,035	10	0,010	10
2		0.22	0,037	10	0,012	10
3		0.28	0,040	10	0,015	10
4	119.3	0.18	0,039	10	0,013	10
5		0.22	0,040	10	0,015	10
6		0.28	0.043	10	0,018	10
7	155.1	0.18	0,042	10	0,018	10
8		0.22	0,044	10	0,020	10
9		0.28	0,046	10	0,023	10

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The results of the wear test analysis chisel edge (VB), the obtained chisel Al_2O_3 + TiO_2 softer than the chisel TiO_2 observed from the data in Table 3 above. From table-3 can be obtained as a result of the growth of tool wear and the cutting speed of feed rate that can be given on a growth chart tool wear as follows:

Flank Wear of Tool TiO_2

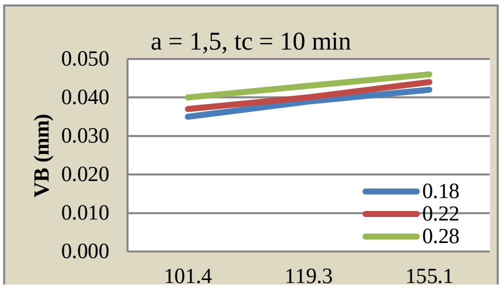

Figure-3 Growth charts TiO_2 carbide tool wear due to the cutting speed

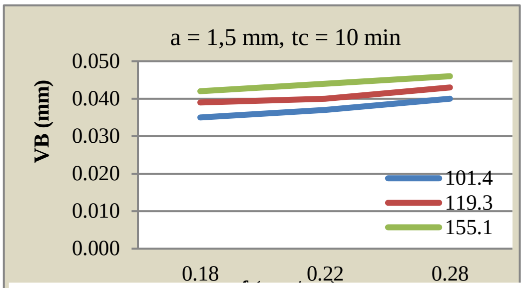

Figure-4 Growth charts TiO_2 carbide tool wear due to feed rate

Of image 3 and image 4 is then seen that the graph has a positive impact on the value of tool wear, meaning that the higher the cutting speed and feed rate used then the higher the value of the edge flank wear that occurs.

Flank Wear of Tool Al_2O_3+TiO_2

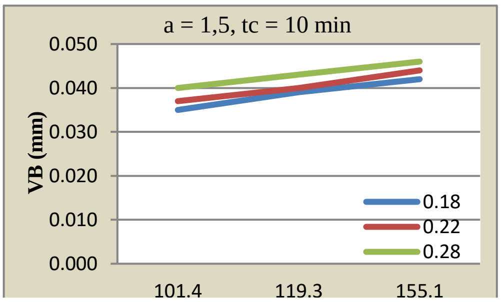

Figure-5 Growth charts Al_2O_3 + TiO_2 carbide tool wear due to the cutting speed

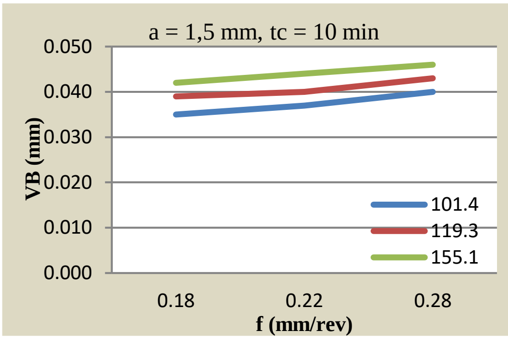

Figure-6 Growth charts Al_2O_3 + TiO_2 carbide tool wear due to feeding

From the figure-5, and figure-6 can be seen that the influence of the cutting speed and feed rate on tool wear due to friction depth of cut funeral with a fixed value of 1.5 mm has an effect on the value of tool wear, ie, the greater value meal motion and speed used the higher the value the edge flank wear that occurs on the chisel.

Conclusion

Based on the results of research and discussion, it can be concluded as follows:

a. The results showed that variation of cutting speed and feed rate significantly influenced the wear growth of Al_2O_3 + TiO_2 tool and TiO_2 tool on dry steel process.
b. The application of cutting speed variation and feed rate with depth of cut fixed the growth of most small tool wear is on the cutting speed 119,4mm/min, feed rate 0,18 mm/rev and depth of cut 1,5 mm using a carbide cutting tool inserts TiO_2.
c. Hardness testing results obtained to tool Al_2O_3 + TiO_2 is 87,82 HRC and tool TiO_2 is 87,52 HRC.

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