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Tool Wear Studies on EN8 Material

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Abstract:

Most of tool wear studies are classified as experimental (e.g. Taylor's equation); thus, the physical nature of the wear phenomenon is still a matter of interest. One such Challenge involved in the measurement of wear of a single point cutting tool is Attrition volume wear which is in order of cubic Microns and not in a uniform straight line. In this paper we address the using Image processing techniques that offer superior ability to visualize and measure tool wear and also the variation of surface roughness of the work piece with respect to tool wear of single point high speed steel during machining of a Medium carbon steel EN8

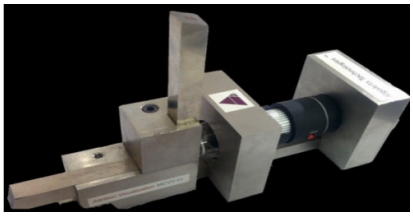
Keywords —Tool wear,EN8 Work Piece, Attrition Volume, Calibration grid, Image processing, Surface Roughness

I. INTRODUCTION

Tool wear describes the gradual failure of cutting tools due to regular operation. It is a term often associated with tipped tools, tool bits, or drill bits that are used with machine tools.Consequently, tool life in general cannot be predicted by extending the result from one study. By understanding the physical nature behind such as material properties of Tool and work piece, important wear mechanisms can be identified.

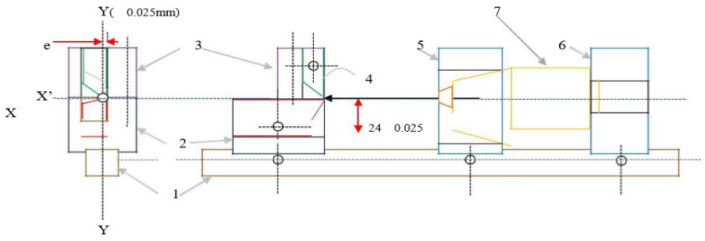
II. METHODOLOGY

Attrition Visualization MCVV01:



Tool wear Image Capture Equipment

Schematic:



Nomenclature:

1: Base

2: Tool-holder (tool in horizontal-position)

3: Tool-holder (tool in vertical-position)

4: Tool shank

5: Camera-holder (front)

6: Camera-holder (rear)

7: Camera

Note: X'X is the line of sight of camera, the circle at the intersection of X'X and Y'Y is the area of tool-tip under observation. e = 0.2

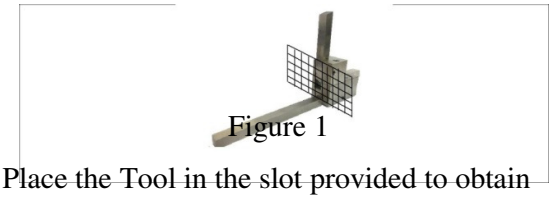


Figure 1

Tool-Wear Attrition Measurement and Visualization

All Images of the Tool and the Calibrated Grid (0.1mm) are captured at room temperature with fixed distance between Camera and Tool (25 mm)

1. Load the camera software provided in the product box.
2. Keep the calibrated grid in a plane where we expect to see attrition, see Figure1. Obtain Image of the Calibrated Grid using the camera software. Calibrated grid sheet is provided in the product box.
3. Place the Tool in the slot provided to obtain Top View of the Image of the Tool before machining
4. Get Top View of the Image of the Tool after machining.
5. Place the tool in the slot provided to get Front View of the Image of the Tool after machining,
6. Load Image Processing Toolbox
7. Enter the grid image and Top View imageof the Tool after machining in the command window
8. Execute the above to display a superimposed image.

III. WORK PIECE AND ITS COMPOSITION:

EN8 Alloy:
EN8 is a medium carbon steel with improved strength over mild steel.

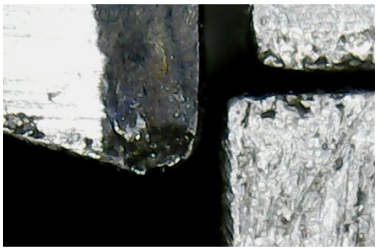
	C	Mn	Si	S	P	Cr	Ni
EN8	.36 – .44%	.60 – 1.00%	.10 – .40%	.050 Max	.050 Max	-	-

EN8 Alloy Steel Round Bar Mechanical Properties:

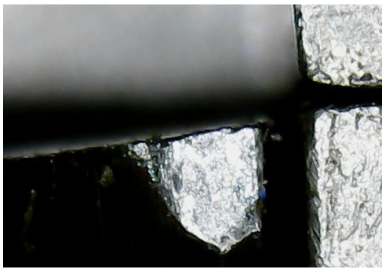
Condition	Tensile Strength (MPa)	Yield Strength (MPa)
N	510-550	280
Q	625-775	385

IV. Characterization and Estimation of Tool Wear V_W:

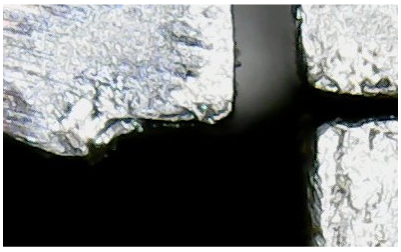
Top View of the Image of the Tool before Machining



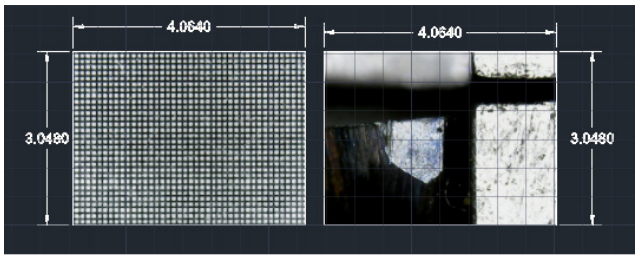
Front view of tool after machining



Top view of tool after machining

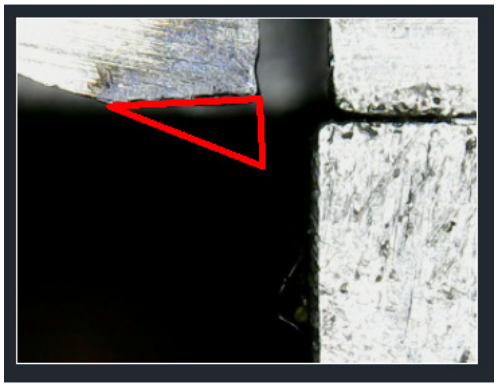


A Calibrated grid is to be created with 0.1mm using AUTOCAD and resize the image obtained in the camera to accommodate in the calibrated grid through which volume wear is to be derived by creating a 3D model with the help of images obtained. Volume command in AUTOCAD is used to obtain the volume of the solid model obtained.



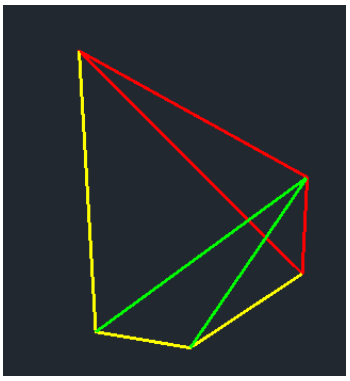
Calibrated Grid correlated to the image obtained

Front View of Tool wore after machining



Top View of Tool wore after machining

Solid Model Obtained by imposing Front and top view



Wireframe model obtained

V. RESULTS:

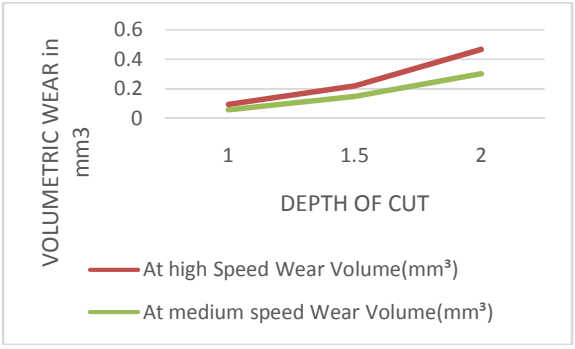
The results obtained by varying the depth of cut at High Speed and Medium Speeds are as follows

S.No	Depth of Cut(mm)	At high Speed (700 Rpm)Wear Volume(mm^3)	At medium speed(460 Rpm) Wear Volume(mm^3)
1	1	0.0923	0.0564
2	1.5	0.2182	0.1477
3	2	0.4661	0.3009

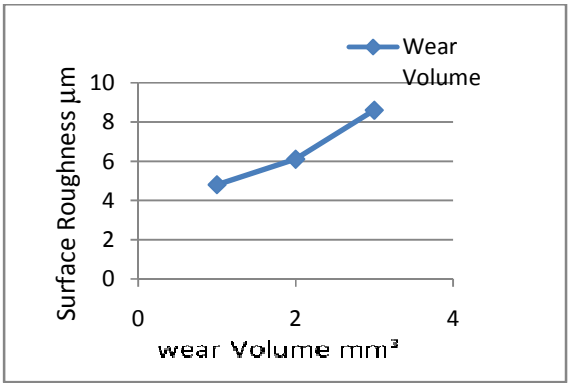
Surface Roughness Variation due to wear at High speed is given below. It is observed that as wear increased surface roughness increased.

S.No	Depth of Cut(mm)	Wear Volume(mm^3)	Surface Roughness variation at high Speed(µm)
1	1	0.0923	4.8
2	1.5	0.1182	6.1
3	2	0..1661	8.6

Variation of volume wears at high(700 Rpm) and medium (460 Rpm) speeds with respect to depth of cut



Variation of surface roughness with respect to wear volume is represented below. As wear increased surface roughness increased.



VI. CONCLUSION:

The Variation of tool wear material with respect to speed, depth of cut and the changes in surface roughness with wear are during the turning operation for EN8 material using Image processing techniques and AUTOCAD it is observed that as depth of cut increased tool wear increased and as tool wear increased surface roughness increased with increase in tool wear which resulted in poor surface finish. We further extended study for other materials

REFERENCES:

[1]User Manual Attrition Visualization MCVV01-AlgoArts Technologies

[2]http://saajsteel.com/en-series-steel-grade-en-18/

[3]http://www.ssroundbar.com/roundbar-rodbar/alloysteel-roundbar-alloysteel-rodbar/rodbar-type-en18-alloy-roundbar/

[4]http://www.atozsteel.com/chemical-composition.html

[5]http://www.astmsteel.com/product/en8-carbon-steel-080m40-bs-970/

[6]http://www.highpeaksteels.com/en8-steel-properties/

[7] Outokumpu-stainless-steel-handbook

[8]Journal on Tool Wear Monitoring when Turning EN 8Steel with HSS-M2 ToolVikas B. Magdum1, Vinayak R. Naik2
M.E. (Mech) student, Department of Mechanical Engineering, Textile and Engineering Institute, Ichalkaranji,

[9]Text book of Machine tools and Tool Design by PC Sharma

[10]Fundamentals of Machining and Machine tools by Geoffrey Boothroyd

[11]Analysis of Machining and Machine Tools

By Authors: Liang, Steven Y., Shih, Albert J