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HoT Turning Operation in Finite Element Analysis

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ABSTRACT

There is a requirement for materials of high hardness and protection from cutting. As we probably aware the machining of these materials has dependably been an incredible test. Machining of these composites and materials required for cutting high-quality, which now and again isn't prudent and in some cases even illogical. Also, even the non-ordinary procedures are by and large constrained to the perspective of efficiency. The benefits of simple part assembling of exorbitant hard materials can be considerable as far as decreasing expenses and lead times machined contrasted with the customary one includes the warmth treatment, granulating and manual completing/cleaning. In the hot working at a temperature of work piece is expanded in order to decrease its shear quality. This paper will centre around hot working of high manganese steel with oil fuel. A few parameters, for example, cutting pace, feed, profundity of cut and the temperature of the work piece are taken. An investigation was led. Indeed, even the machining process was reproduced in ANSYS and Disfigure 2D to discover relating distortion, rate of hardware wear, cutting power and the temperature dissemination.

Keywords: FEA, Hot machining, Non-Conventional Processes, Tool Wear

I. INTRODUCTION

The performance during last two decades in the material science technology over advanced and the path which is showing a necessity and to produce the alternate exotic materials by this advancement intelligent material became very essential to meet the strength requirements this leads to produce super alloys and hard materials became essential to meet the design requirements for the specially in aerospace and defence industries then the processing of such a materials had always been a great challenge for the production group add recent Technology advanced materials having the good properties in the field of electrical nuclear science and technology orthopedics means dental and Aerospace industrial applications to enhance doors directional accuracy with exact dimensions and to life and surface roughness of a quantity availing 8 satisfactory but the processing and production whereas the should the component are to be produced within the satisfied and stipulated as compared with the conventional process and in which the metals leads to related to heart treatment or to be followed annealing the materials and metal and rock Rashid and finishing operations the operations carried out like raining and rough surface finishing like polishing which intern good leads to a lot of man effort work space and time.

The moulding operating which contains had a difficult task in real time to obtain the good to life and good surface finish while working with material the basic operations which are required harassed install oil tools which are having the high cost sometimes those impossible wWE Sting operations on while the let me try removing material in life in a large proportion like or bulk removal of materials of BAMS operations will get value to In The Hot Zone between wordpress and the tool which leads to failure of tool or damage the work piece.

II. METHODS AND MATERIAL

FEA

Issue Proclamation: A cylindrical and hollow workpiece of dia 50 mm and length of 500 mm is pivoted in a turning focused RPM at 600 rpm. The workpiece is continually warmed with a warmth source in development which is a fire (LPG + O2). We need to plan a model in CFD and do examination to discover the temperature dispersion of the workpiece, instrument and chip. The temperature of the workpiece surface in contact with the fire is shifted from 200-600°C.

Workpiece material= High manganese steel,
Workpiece length= 500 mm,
Workpiece diameter= 50mm,
Rotational speed N= 600 rpm,
Flame travel= 0.1 mm/rev,
Feed = 0.1 mm/rev.

Table 4.1 Chemical Composition of Workpiece (High Manganese steel):

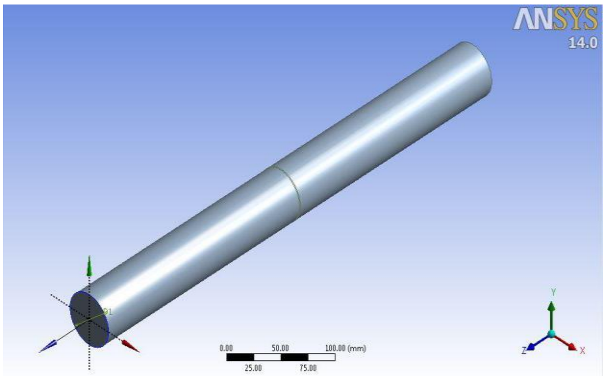
Metal	Mn	C	Si	Cr	P	S	Fe
%	12.5	1.2	4	1.6	.058	.01	84.23

Table 4.2 Work material properties:

Work material	Density (Kg/mm^3)	Specific heat (J/Kg-K)	Thermal conductivity (W/mm-k)
High Manganese Steel	7.8×10^{-6}	Cp= 420+ 0.67T	0.05

A cylindrical work piece is modeled in Ansys having the following dimensions.

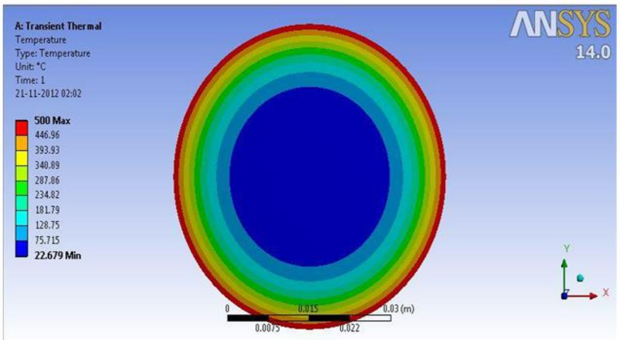
Diameter: 50 mm
Height: 500 mm



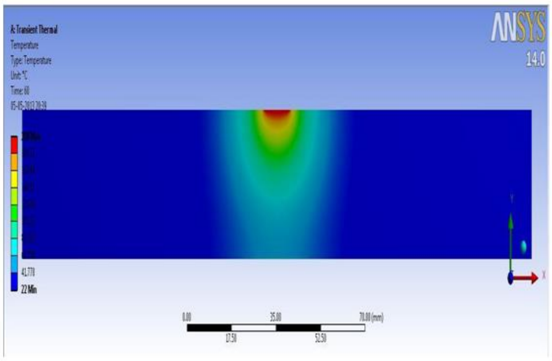
In this analysis we assume a uniform heat source of temperature 5000°C acting along a width of 10 mm along the surface of the workpiece. In the above figure a small circle can be seen (from z=245 mm to z= 255 mm) which is the heat affected region.

Since the heat source is uniform and heat flows uniformly through the workpiece 2D analysis is conducted by taking the following:

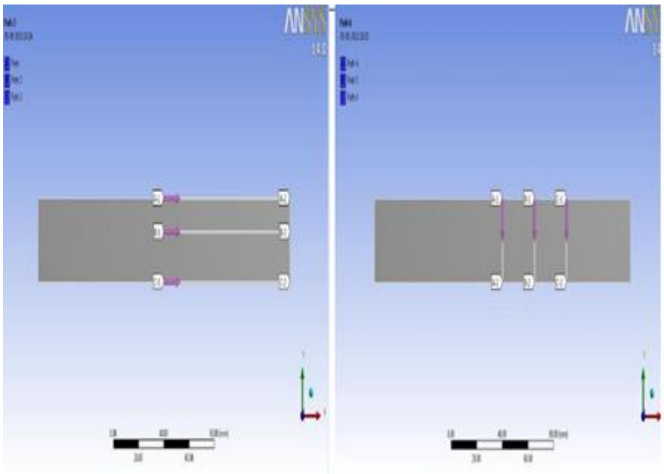
Radial cross section (Circular cross section)
Axial cross section (Axisymmetric Rectangular cross section)



Temperature Distribution

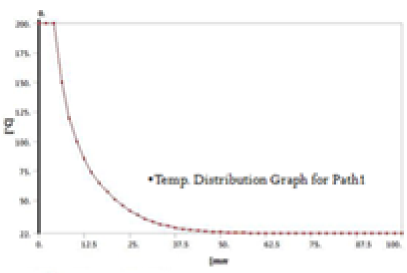


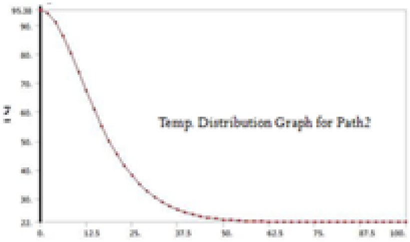
Path 1: From centre of the flame (0, 0) to x = 100 mm.
Path 2: From 15 mm below the surface (0, -15) to x = 100mm (100, -15).
Path 3: From 25 mm below the surface (0, -25) to x = 100mm (100, -25) i.e. along the axis.

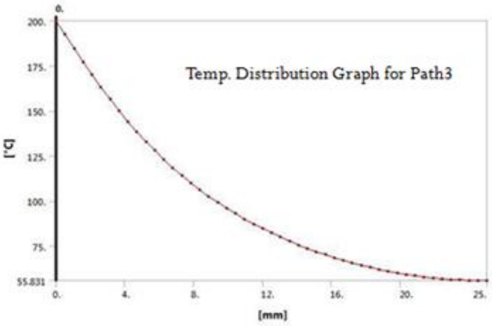


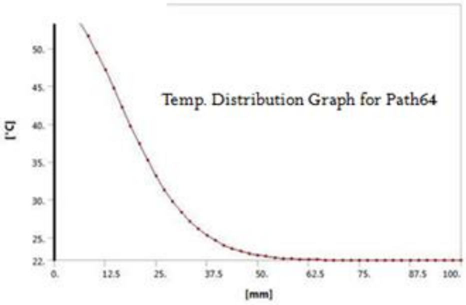
Path 4: From centre of the flame (0, 0) downwards to y = -25 (0, -25).
Path 5: From (25, 0) to (25, -25)
Path 6: From (50, 0) to (50, -25)

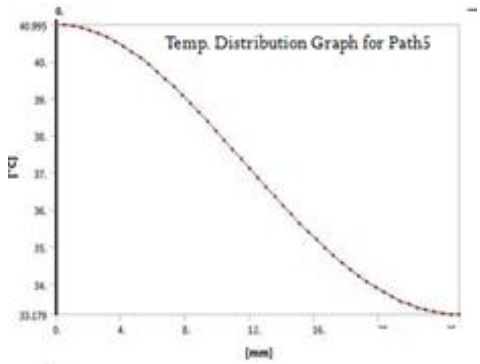
III. RESULTS AND DISCUSSION

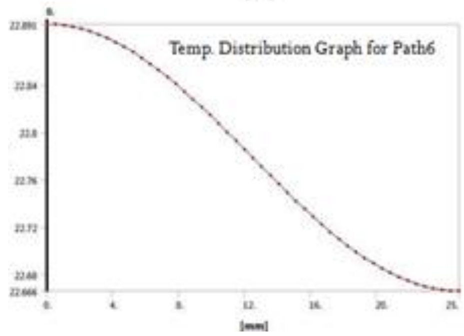


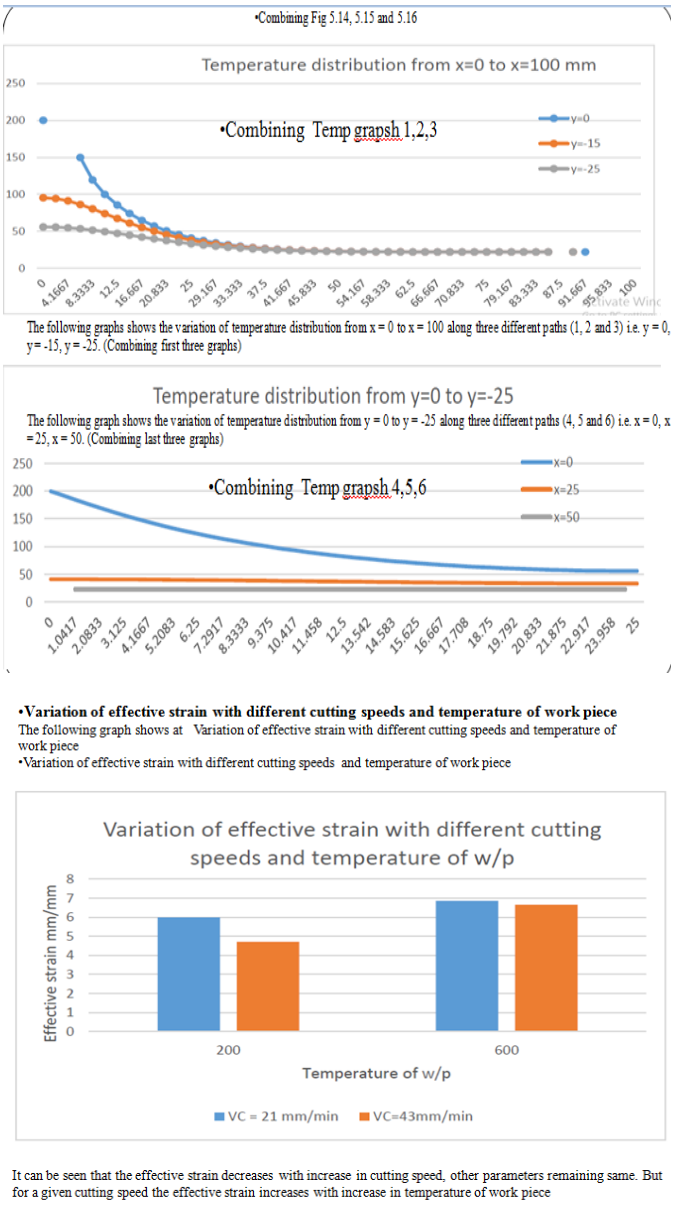












Tool Wear Rate and Cutting Forces:

It can be observed from the figures of tool wear that a minute red region representing high tool wear rate is seen on the model this region vanishes. Hence it can be concluded that on increasing the temperature of the work piece the tool wear rate decreases. Similarly from the figure of Cutting force and thrust force it can be concluded the on increasing the temperature of work piece the cutting forces decrease.where the temperature of the work piece is taken to be 200°C. On increasing the temperature to 600°C

IV. CONCLUSION

- The temperature of the chip tool interface increases with increase in cutting speed.
- Effective strain decreases with increase in cutting speed, other parameters remaining same. But for a given cutting speed the effective strain increases with increase in temperature of work piece
- On increasing the temperature of the work piece the tool wear rate decreases.
- On increasing the temperature of work piece the cutting forces decrease.
- Hot machining procedure can be utilized for machining hard materials. Be that as it may, there are a few inadequacies. The setup with a warming source ought to be accessible. Prepared staff should utilize the fire. Warmth ought to be consistently conveyed all through the cross area and care ought to be taken not to overheat the work material as it will change the metallurgical properties.
- With increase in temperature the effective stress increases

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