Grenze International Journal of Engineering and Technology, Special Issue

Economizing of Machining Process by Heating the Work Piece in the Furnace to Increase Tool Life, Surface Finish and to Reduce the Power Consumption

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***Abstract*—This paper focuses on economizing of machining by increasing the temperature of the work piece to above the room temperature and below the recrystallization temperature depending on the materials to be machined and their compositions. The heating is achieved by using an electric furnace which is a safe practice compared to gas torch heating. The process parameters are calibrated by the lathe tool dynamometer to measure the cutting forces on X,Y and Z directions. Temperature measurement by Non contact type infrared thermometer .Surface roughness values are measured by –Surface roughness measuring equipment. thus the cost of machining is reduced and that/s how the Economizing in Machining is possible.**

***Index Terms*— Furnace heating, Cutting Forces, Surface Roughness Tool life.**

I. INTRODUCTION

In Present days to satisfy industrial requirements we should have materials with high hardness and shear strength. so manufacturers are intended to manufacture such material having high hardness and shear strength.

There are various conventional methods for machining but use of such method reduces tool life with increase in tool wear. This results in increasing cost of manufacturing. Many alloys in use at present time, such as those employed in gas turbine are practically impossible to machine at room temperature. Power consumed during turning operations is primarily due to shearing of the material and the plastic deformation of the metal removed since both the shear strength and hardness values of engineering Materials decrease with temperature, it was thus postulated that an increase in working temperature would reduce the amount of power consumed for machining eventually increase the tool life.

In hot machining the part is heated before the machining. This heating of the material makes to reduce the hardness of material and become soft, resulting in improved mach inability, high production rate, low power

Grenze ID: 01.GIJET.4.3.10

consumption. From all this disadvantages, hot machining is extremely useful to machine hard to cut materials. Typically mild steel has a melting point of 1350 to 1530°c depending upon the amount of carbon it contains. Many techniques are employed for heating the material but here we are employing electric arc furnace which is easiest way as compared to other techniques.

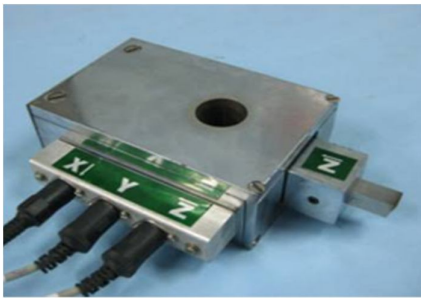
II. Experimental Setup

1. Lathe: the experimental Apparatus for turning the material in hot condition is built on lathe machine. Lathe is the name of the machine tool used for turning process in which the work piece is located and a single point cutting tool of H.S.S. material brought to the surface of the work piece resulting in removal of excess material in the form of chip

2. workpiece: Mild steel on which the entire experiment is be done.

3. Lathe tool with Dynamometer: Dynamometer is a device which measures the forces acting during cutting operation these forces are used in our experiment for the calculation of power required for removing material from the given work piece. In our experiment. we are using 3 Axis.

Fig 1: Lathe Diagram



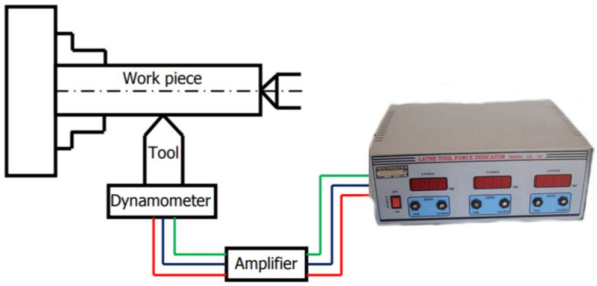


Fig 2: Diagram of dynamometer with H.S.S tool

4. Temperature measuring device: Here for measuring the temperature we are using non-contactable laser thermometer. we are using this thermometer because temperature can be easily measured without direct contact with the hot material by this we can avoid accidents related to hot temperatures.

Fig 3: Diagram of Non contact type Infra Red thermometer

5. Procedure:

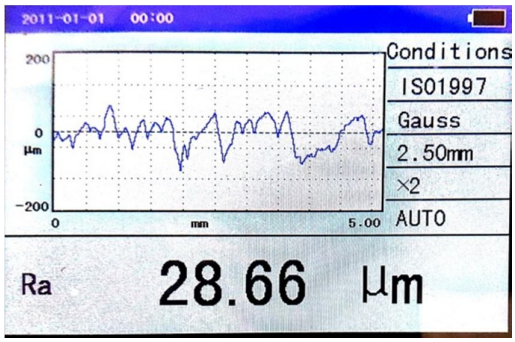
Cold specimen:
In this experiment two rods of 25 mm diameter and length of 100 mm of Mild steel turned by fixing the jobs in lathe chuck and maintaining constant speed 295 rpm , depth of cut 0.5 mm ,at Temperature 25 deg Celsius. Dynamometer readings were taken and entered in the tabular column. Here the entire experiment is carried on it room temperature and pressure. Dynamometer readings were taken and entered in the tabular column

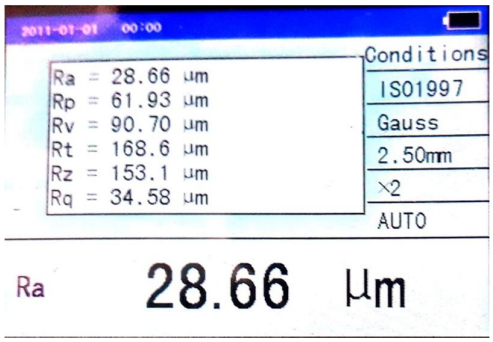
Hot specimen:
Now the metal rod heated to 250 deg Celsius. temperature below the melting point in the furnace and fitted in the Lathe machine chuck for turning operation. The temperature of the material is recorded with the help of laser thermometer. 250 deg Celsius. Dynamometer readings were taken and entered in the tabular column. In both the cases carbide tipped tool arrangement along with three Axis dynamometer is employed in order to measure the cutting forces acting on the work piece.
Readings of dynamometer are recorded for cutting forces calculations and used for calculating the power consumed for machining the work piece.

Experimental results

Cold specimen: Material: Mild steel Length:100 mm Diameter :25 mm Temperature: 25°

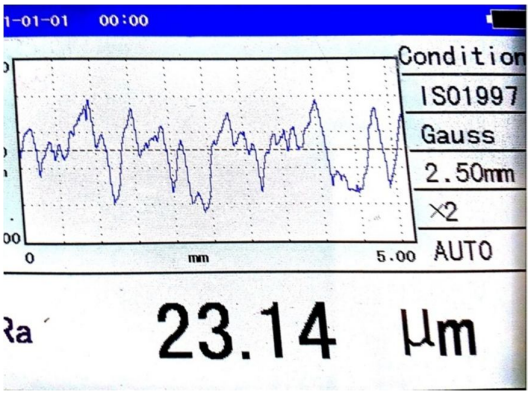
S.no					Rpm	Depth (d) (mm)	Initial diameter (mm)	Fx (N)	Fy (N)	Fz (N)	Final diameter (mm)	Cutting speed (m/min)
1	295	0.5	25	78.45	254.97	353.03	24			23		

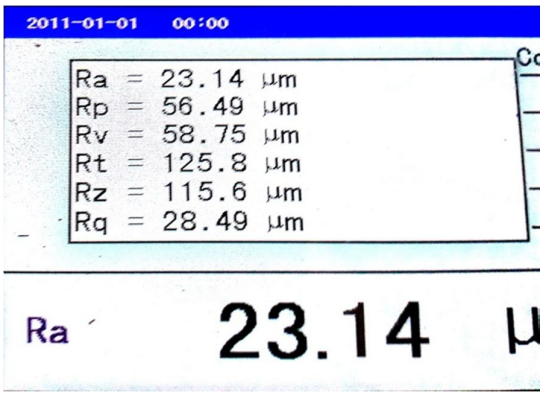


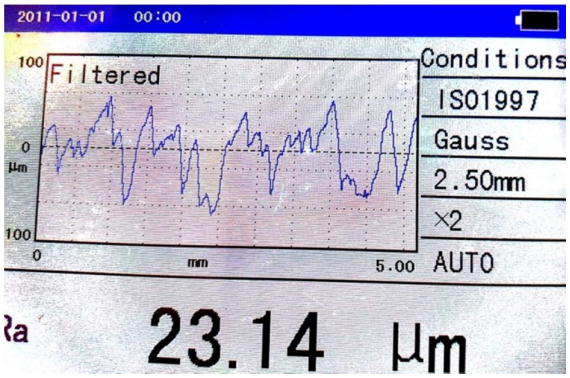


Hot specimen: Material name: Mild steel Length: 100 mm Diameter: 25 mm Temperature:250 °

S.no	Rpm	Depth (d) (mm)	Initial diameter (mm)	Fx (N)	Fy (N)	Fz (N)	Final diameter (mm)	Cutting speed (m/min)
1	295	0.5	25	49.03	205.94	304.00	24	23







III. Discussion

It was noted that during machining at room temperature due to high hardness and shear strength the stainless steel and mild steel consume more power for material removal process in turning and eventually consuming more time. In the next case it was observed that due to heating of material below their melting point The structures of material become soft by reducing it's hardness and shear strength and thereby machining is done so easily. In this experiment cutting time and speed and feed are made constant and our only concentration is made on economizing the power consumption rate of hard material thereby heating them and softening them. From the tabular reading it was observed that as the temperature of the material is increased, metal removal rate is also increased and thereby power consumed for same material removal rate as compared with experiment at normal room temperature is decreased and thereby increasing the efficiency of machine tool where is reduced by the experiment.

IV. Conclusion

It was concluded that heating of hard material to certain temperature leading to softening them ,by this process make them to machine easily without more tool wear and thereby decreasing the machining cost

successfully. The main objective of the experiment is to decrease the tool wear while machining high strength materials and decrease the power consumption rate ,and to increase surface finish.

REFERENCES

[1] R. D. Rajopadhye1, M. T. Telsang2, N. S. Dhole3, Experimental Setup for Hot Machining Process to Increase Tool Life with Torch Flame**.** IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) ISSN: 2278-1684, PP: 58-62 www.iosrjournals.org

[2] Mukherjee, P.N., Basu, S.K., 1973. Statistical evaluation of metal cutting parameters in hot machining. Int. J. Prod. Res. 2, No-1-21-36.

[3] N.Tosun,L.Ozler,2002,A study of tool life in hot-machining using artificial neural networks and regression analysis method, J. Material processing technology 124,99-104.

[4] N. Tosun ,L. Ozler, 2004, Optimization for hot turning operations with multiple Performance characteristics, Int J Adv Manuf Technol 23, 777– 782.

[5] K.P. Maity, P.K. Swain, An experimental investigation of hot machining to predict tool life, Int. J. of Materials processing technology 19 8 (2008) 344–349.

[6] Rozzi, J. C. , Pfefferkorn, F. E., Shin, Y. C., and Incropera, F. P., "Experimental Evaluation of the Laser Assisted Machining of Silicon Nitride Ceramics.", Journal of Manufacturing Science & Engineering, Transactions of the ASME, Vol. 122, Iss. 4.