Analysis of Cutting Speed on Surface Roughness Relationship Through St-90 Material Lathe Using Chisel Carbide

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***Abstract*—** The dry machining process using a lathe is one of the alternatives used in this research to work on the production process oriented procession. The purpose of this study is to improve the quality and efficiency of the results of the latter. Achievement quality of a product on the lathe is by looking at the level of surface roughness obtained at cutting conditions. This research reveals the effect of cutting speed on the surface roughness of the ST-90 material in the experimental dry turning process using carbide carbide eyes. Method of measuring surface roughness with mitutoyo SJ-310 terutoyo surface means the highest mean roughness value (Rough) obtained Ra = 1,544 µm, Rq = 2,040 µm and Rz = 11,021 µm happened at cutting speed 110,658 m / min. The smallest (smoothest) surface roughness value obtained was Ra = 0.954µm, Rq = 1.210 µm, Rz = 6.606 µm occurring at a cutting speed of 66.411 m / min. From the results of research conducted it can be concluded that the faster cutting speed (cutting speed) used on dry material drying ST-90 then the value of surface roughness of the results obtained a large lathe.

Keywords—*ST-90, Cutting Speed, Surface Roughness*

I. INTRODUCTION

A lathe is a process of forming the material by removing some material in the form of beram due to the relative motion of the chisel to the workpiece. The workpiece is rotated on the spindle. The chisel is delivered to the workpiece in translation. To improve the quality and efficiency of the machining process and to create technology which is environmentally friendly (Green Tecnologies), then found a method of dry drying (dry turning). In the process of disinfection without using coolant.This is not only environmentally friendly, but it can reduce the cost of production expenditure. It should be noted, however, that the benefit of coolant to reduce the coefficient of friction and heat will not occur for dry machining will be acceptable only if the quality of work accomplished in wet rolling is equivalent or better. Good machining results will produce good quality workpieces as well. in addition, the condition of machinery, materials and good work tools become factors that affect the results of good products even technicians who run it have experienced or have received education in the world of machinery [1]-[6].

Some things are quite influential on the quality of the workpiece produced in the process of lathing, one of which is the surface roughness. Surface roughness plays an important role in the design of machine components. In the lathe process, the roughness of the work is of paramount importance, the quality of the lathe is strongly influenced by the type of chisel used such as High Speed Steel (HSS) and Carbide. In addition, cutting speed (Cutting Speed) is one of many things that can affect the results of t,he lathes. The quality of cutting surfaces on a metal depends on the cutting conditions, by using standardized cutting speeds, the resulting flatness will be obtained as desired [7]-[8].

This research was conducted to obtain surface roughness data of dry processor result, which is a metal cutting process using a conventional lathe with carbide cutting tool and without using coolant in ST 90 material commonly used in automotive industry. In the process of the specimen, the lathe is varied by cutting speed to constant feed. The results of the specimen lathe will be measured using a Roughness Surface Tester to determine the surface roughness value.

From the above problem, the purpose of this research is to analyze the influence of cutting speed (Cutting Speed) to surface roughness result of ST 90 material, and difference of surface roughness to cutting speed (Cutting Speed) 66,411 m / min, 88,548 m / min, and 110.658 m / min on ST 90 steel burring process.

II. LITERATURE REVIEW

The machining process is a process in the manufacturing world by using production machinery which is a continuation in the process of forming an akhier process after the formation of metals into raw materials of wrought iron or alloy steel or formed through a casting process prepared with a shape close to the actual shape of the object . In the machining process, there are several processes to produce products ranging from raw materials processed in certain ways in a sequential and systematic way to produce products that function. A machine component has the ideal geometry characteristics if it can be used in accordance with what the machine needs, and must have the right size / dimension, perfect shape, and smooth surface. But in the process, it is not possible to create a component with the characteristics of the ideal geometry. The unavoidable thing is that there are deviations during the manufacturing process so that the end product does not have the ideal geometry. Factors of irregularities in the metal cutting process are the adjustment of machine tools, measurement methods, the movement of the tooling machine, the wear of the chisel, the temperature, and the cutting forces [9]-[11].

1. Machine Tool

Machine Tool is a machine tool used to cut the rotated object. Lathe itself is a process of fixing the workpiece whose incision is done by rotating the workpiece then worn on the chisel which is moved in translational parallel to the axis of rotation of the workpiece [17]-[18].

2. Lathe Tool

The lathe process is one of the machining processes to produce machine components [20]-[21]. Where the lathe process is included in the machining process using a chisel The lathe (turning machine) is a type of machine tool that in the process of work moves rotate the workpiece and use a cutting chisel as a tool to cut the workpiece.In the process, the workpiece is first mounted on a chuck mounted on the engine spindle, then the spindle and workpiece are rotated at a speed as calculated. The cutting tool (chisel) used to form the workpiece will be slashed on a rotating workpiece. Generally chisel lathe in a state of silence [12]-[16].

A certain type of machining work requires a chisel from a suitable material [15]. The chisel is one of the main components that play an important role in the machining process.

3. Surface Roughness Tool

This study uses a surface tester gauge that works because of a needle detector to feel the surface to be measured. The needle moves along the predetermined size at the initial setting, so that it will get some point according to the desired setting. Detection can be done 3 parameters, Ra, Rq, and Rz in DIN or ISO / JIS specification.

III. RESEARCH METHOD

This research is experimental research. The reseach was carried out in the Workshop and Laboratory Workshop (BLK), Jl Taman Makam Pahlawan, No. 4 Makassar. This reseach was conducted in June - July 2017.

Research Tools and Materials

The research using materials and tools as follows:

1. Material

The material used in this research is ST ST 60 with dimensions ø 24 mm x 150 mm as many as 9 pieces.

2. Tools

The tools used are as follows:

a. One unit of horizontal lathe machine SMI type made in Austria in 2002 along with the completeness.
b. Surface Tester Brand Mutitoyo type SJ 310.
c. Sculpture Insert Carbide.
d. Term Sorong Mutitoyo brand
e. Safety standard equipment.

3. The process of lathe

a. Lathe operation by using a lathe.
b. The workpiece is ST 90 steel, and there are 9 workpieces used.
c. The workpiece is flat with 3 variations of cutting speed, 66,411 m / min, 88,548 m / min and 110,658 m / min. At each variation of cutting speed is done 3 times the experiment.
d. The cutting depth of the lathe is constant at 1 mm.
e. Each workpiece is latched using the same lathe.
f. The used chisel is carbide carbide with insert carbide type.
g. The length of the lathe is 100 mm.

4. Roughness Testing Processa.

Test materials that have been cut and then sequential numbers to facilitate the collection of data.b. Each surface of the test material will be measured by its roughness by placing the surface tester on the surface of the measured sample.c. The measurement results will be displayed roughness value on the monitor surface tester.d. With the completion of the surface roughness measurement, the measurement data is ready for use.

IV RESULTS AND DISCUSSION

Surface roughness test results

The surface roughness test is used to know the roughness value of workpiece result by using Mutitoyo surface tester surface tester which works through the needle detector to feel the measured surface along the predetermined size at the initial measurement. The results of roughness testing in this study in the form of tables as follows:

Table 1. Roughness Testing Results

No	**Cutting Speed (m/menit)**	**Spesiment**	***Surface Roughness* (µm)**		
			Ra	**Rq**	**Rz**
1	66,411	1	0,810	1,02	5,862
		2	1,009	1,283	6,741
		3	1,044	1,328	7,216
2	88,548	1	1,092	1,527	12,938
		2	1,074	1,507	9,063
		3	1,180	1,451	6,898
3	110,685	1	1,404	1,835	9,699
		2	1,599	2,074	10,905
		3	1,628	2,210	12,431

Table 2. Average value Surface Roughnes

No	Cutting Speed (m/menit)	Average value Surface Roughnes		
		Ra	Rq	Rz
1	66,411	0,954	1,210	6,606
2	88,548	1,098	1,453	9,029
3	110,658	1,544	2,040	11,021

The discussion of the effect of cutting velocity on surface roughness includes:

a. Relationship between the mean of surface roughness and cutting speed (v)

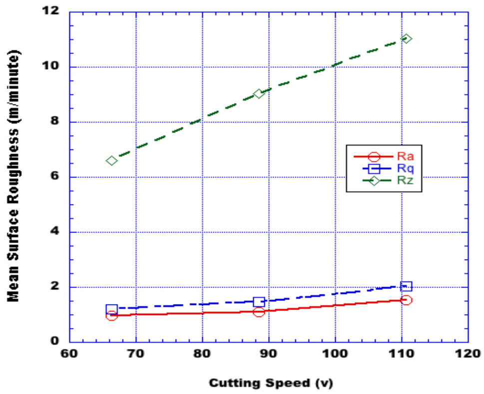

Fig. 1. Relationship of the mean value of roughness of the surface to cutting speed (v)

Based on the surface roughness testing on the result of ST 90 material welding using carbide chisel then the relation between cutting velocity (v) to the mean value of roughness (Ra, Rq, Rz) that the higher cutting speed used in the latter then the surface roughness value of the material the results of the lathe is also greater.

b. Relationship between of mean surface roughness and an engine speed of rotation (n)

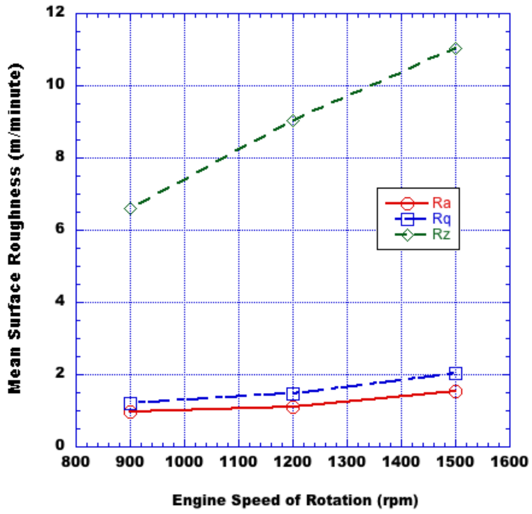

Figure 2. Relationship of mean surface roughness and an engine speed of rotation (n)

Based on the surface roughness testing on the result of ST 90 material welding with carbide chisel then the relation between machine rotation speed (n) to the average value of roughness (Ra, Rq, Rz) that the higher rotation speed of the machine used in the lathe process the roughness of the surface of the resultant material is also greater.

c. Relationship of mean surface roughness and feed speed (vf)

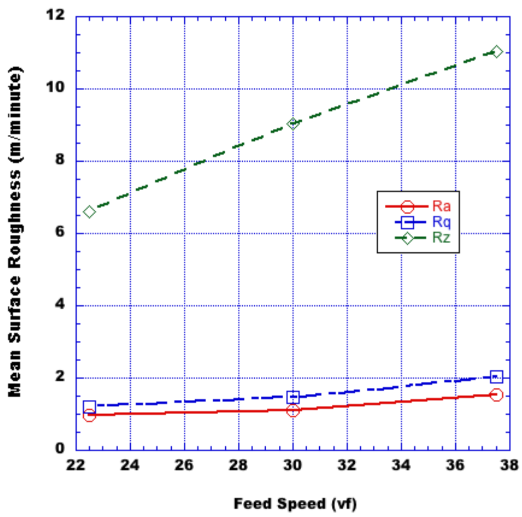

Figure.3. Relation of mean surface roughness to feed speed (vf)

Based on the surface roughness test on the result of ST 90 material welding with carbide chisel then the relation between feed speed (vf) to the average value of roughness (Ra, Rq, Rz) that the higher cutting speed used in the latter then the surface roughness value of the material the results of the lathe is also greater.

d. Relationship of mean surface roughness and cutting time (tc)

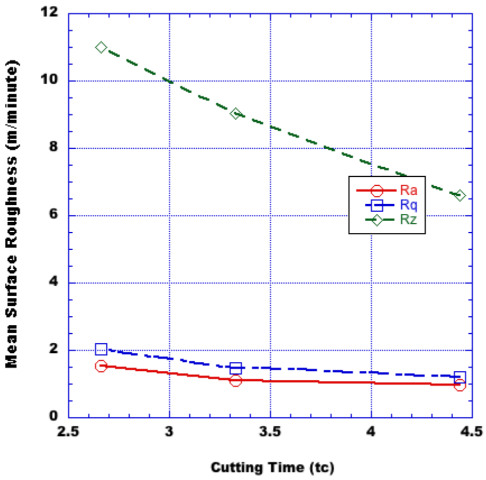

Figure 4. Relationship of mean surface roughness and cutting time (tc)

Based on the surface roughness test on the result of ST 90 material welding with carbide chiseling then the relation between cutting time (tc) to the mean value of roughness (Ra, Rq, Rz) that the longer cutting time used in the latter then the surface roughness value of the material the result is also smaller pengubutan, while the faster the cutting time used in the latter then the surface roughness value of the resulting material will be greater.

e. The relationship of the mean value of surface roughness to the speed of furious income (z)

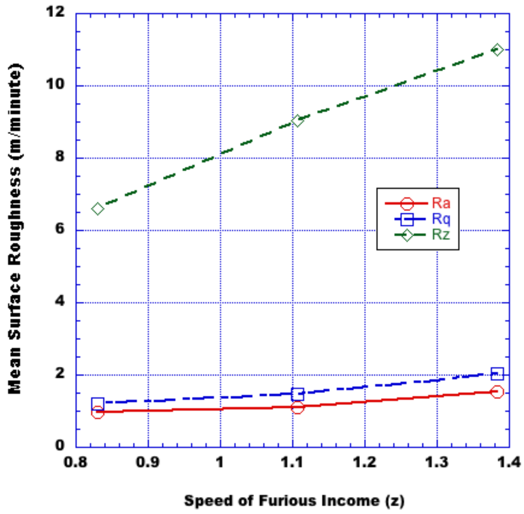

Figure.5. The relationship of the mean value of surface roughness to the speed of furious income (z)

Based on the surface roughness testing on the result of ST 90 material welding with carbide chisel then the relation between the velocity producing rate (z) to the average value of roughness (Ra, Rq, Rz) that the higher the yielding speed generated at the latter, the roughness value the surface of the resultant material is also greater.

IV. CONCLUSION

The result of research of ST 90 lathe using carbide chisel yielded the biggest roughness value that is Ra = 1,628 µm to cutting speed 110,685 m / min while the smallest roughness value is Ra = 0,810 µm to cutting speed 66,411 m / min so that the higher cutting speed used in then a large surface roughness value is obtained. Otherwise, the higher cutting speed used produces a small surface roughness value.

The result of the research resulted the average surface roughness at 66,411 m / min cutting edge with Ra = 0,954 µm, Rq = 1,210 µm, Rz = 6,606µm. At a cutting speed of 88.548 m / min with a mean Roughness Ra = 1.098 µm, Rq = 1.453 µm Rz = 9.029µm. At a cutting speed of 110.685 m / min with an average value of roughness Ra = 1.544 µm, Rq = 2.040 µm, Rz = 11,012 µm. so the higher cutting speed used in the latter is obtained a large surface roughness value, on the contrary, the higher cutting speed used obtained small surface roughness value.

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