12th International Research/Expert Conference
"Trends in the Development of Machinery and Associated Technology"
TMT 2008, Istanbul, Turkey, 26-30 August, 2008

DETERMINATION OF SURFACE ROUGHNESS DURING THE LATHE PROCESSING OF STEEL 42CrMo4

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ABSTRACT
In this scientific research are being given exploration results of determination of surface roughness during the lathe processing of steel 42CrMo4. For this research, it was used the statistic method with five factors (25+6)
Keywords: *cutting, roughness, chip and tool.*

1. INTRODUCTION

The process of roughness surface is determined with the geometrical dimensions of the surface, the exactness of the dimensions and physical characteristics. With the geometrical characteristics of the surface we understand (mean).
Macrogeometry (ovalitets, conicitets)
Microgeometry of processed surface
With the physical characteristics of the surface, we understand the avoid of Physical-mechanical characteristics of surface stratum detail from the basic material, from the quality of the processed surface depends the way of use of the detail, because exactly from the stratum of the surface begins it's destroying. The surface Microgeometry depends from the shape and the geometry of tool, next step and the activity of other technological factors, which changes the theorical profile of the detailed surface. The Main factors are:
The plastic and elastic deformations
The friction of the rear face of tool.
The rise of the phenomena in cutting-edge.
Vibrations (the dynamic characteristics which happens in the system Machine-Equipment processed piece and tool.
The change of the cutting-edge geometry of tool as a consume result.
In the function of processing metal and cutter conditions, these factors differ. During the processing of plastic Metals, a great influence is in processed surface Mickrogeometry, the size of plastic deformation in cutting zone, the phenomena of rise and vibrations.
As much the metal is plasticized as much is the height of micro rise surface. The cutting speed has a great influence in surface roughness, as much is the cutting speed as less is the deformation value of Metal-plastic, for this reason, the height of Micro-elevated is reduced. During the pure process, the cutting speed should be much greater than during the rough process.

2. CONDITIONS DURING THE EXPERIMENT

2.1. Machine-Horizontal Lathe IK62, with these characteristics: P=10kW, n=12.5÷2000 rotations/min, and feed s=0.035÷2.08mm/rot.

2.2. Tool-Cutting plate from the hard metal P30, SINTAL-ZAGREG, ISO SNMM120404, SNMM120408, SNMM120412, enforced in the body with sign ISO PSDNN2525P12, outcome 25mm, with cutting geometry:
γ=-60, α=60, λ= -60, rε=0.4mm, bf=0.2mm, γf=-200.

2.3. Researching material–Steel 42CrMo4 in the cylinder shape with dimensions Φ68X750/Φ38.5X750mm.

2.4 Apparatus for roughness measurement–Duplex Microscope CARL SEISS type STOLLBERG/ERCGEBTYPS15A/GA6Og

2.5. Experimental researching plan – based on the rating number of the rotations of the machine, consulted literature, professional experience, chemical composition, mechanic features of processed piece and metal cutting instrument are defined cutting conditions: v, s, a, r & χ Tab.1.

Table.1. Conditions for experiment realization

CHARACTERISTICS OF INDPENDENT VARIOUS SIZES					
Nr	Note	Level Code	Maximal 1	Average 0	Minimal -1
1	v m/min]	X_1	67.000	53.000	42.000
2	s [mm/0]	X_2	0.042	0.038	0.035
3	a [mm]	X_3	1.000	0.707	0.035
4	r [mm]	X_4	1.200	0.800	0.400
5	κ [^{0}]	X_5	60.000	51.961	45.000

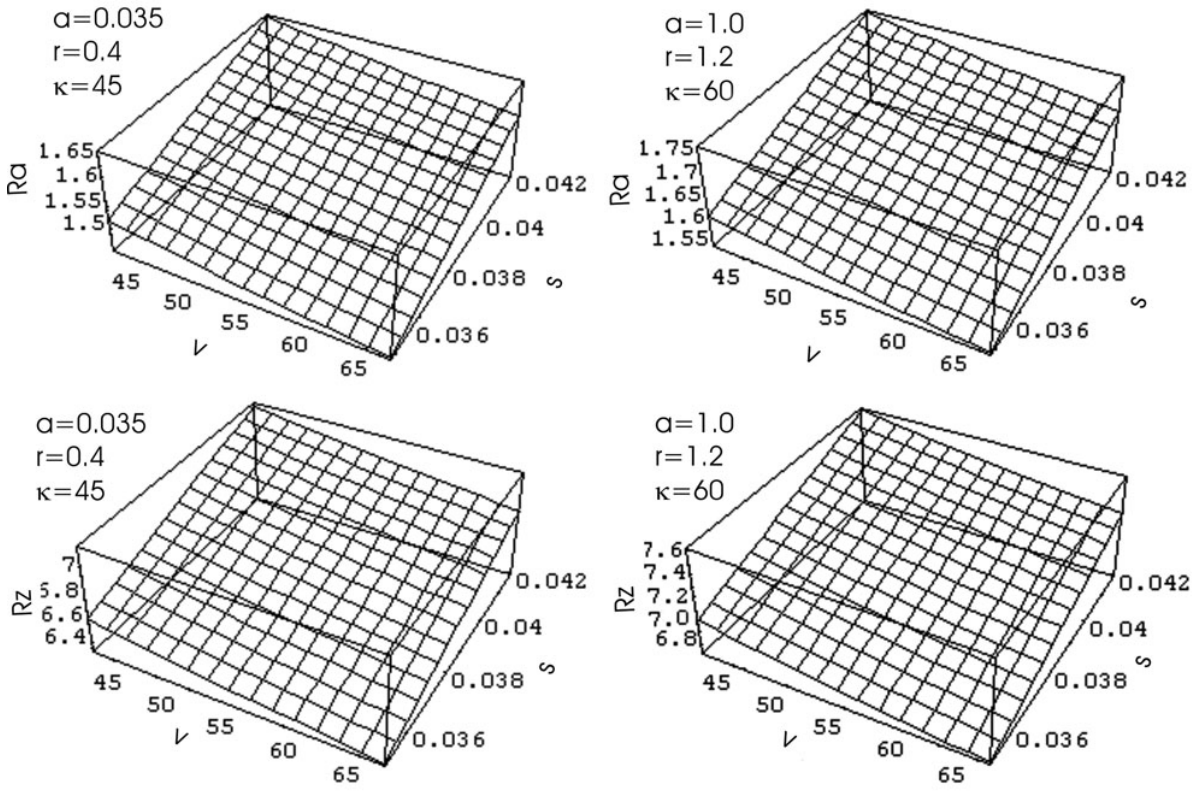

Figure 1. Graphic interpretation of mathematic model (1& 2)

Table 2. Derived results during experiment realization

Nr	REAL PLAN OF MATRICA					REZULTS	
	v [m/min]	s [mm/rot]	a [mm]	r [mm]	κ [°]	Ra [μm]	Rz [μm]
1	42	0.035	0.5	0.4	45	1.605	6.421
2	67	0.035	0.5	0.4	45	1.423	6.692
3	42	0.042	0.5	0.4	45	2.336	9.342
4	67	0.042	0.5	0.4	45	1.938	7.754
5	42	0.035	1.0	04	45	1.792	7.167
6	67	0.035	1.0	0.4	45	1.703	6.811
7	42	0.042	1.0	0.4	45	2.816	11.26
8	67	0.042	1.0	0.4	45	2.117	8.469
9	42	0.035	0.5	1.2	45	1.318	5.271
10	67	0.035	0.5	1.2	45	2.449	9.797
11	42	0.042	0.5	1.2	45	2.165	8.662
12	67	0.042	0.5	1.2	45	1.673	6.693
13	42	0.035	1.0	1.2	45	1.589	6.355
14	67	0.035	1.0	1.2	45	2.165	8.662
15	42	0.042	1.0	1.2	45	1.882	7.527
16	67	0.042	1.0	1.2	45	1.740	6.960
17	42	0.035	0.5	0.4	60	2.262	9.050
18	67	0.035	0.5	0.4	60	1.456	5.825
19	42	0.042	0.5	0.4	60	1.494	5.976
20	67	0.042	0.5	0.4	60	1.400	5.598
21	42	0.035	1.0	0.4	60	1.702	6.809
22	67	0.035	1.0	0.4	60	1.513	6.052
23	42	0.042	1.0	0.4	60	1.697	6.789
24	67	0.042	1.0	0.4	60	1.661	6.643
25	42	0.035	0.5	1.2	60	1.665	6.619
26	67	0.035	0.5	1.2	60	1.645	6.582
27	42	0.042	0.5	1.2	60	1.796	7.185
28	67	0.042	0.5	1.2	60	1.730	6.922
29	42	0.035	1.0	1.2	60	1.589	6.355
30	67	0.035	1.0	1.2	60	1.686	6.742
31	42	0.042	1.0	1.2	60	1.818	7.271
32	67	0.042	1.0	1.2	60	1.768	7.072
33	53	0.038	0.7	0.8	51	1.495	5.980
34	53	0.038	0.7	0.8	51	1.495	5.980
35	53	0.038	0.7	0.8	51	1.496	5.982
36	53	0.038	0.7	0.8	51	1.496	5.982
37	53	0.038	0.7	0.8	51	1.496	5.982
38	53	0.038	0.7	0.8	51	1.496	5.982

$$R_a = 60.478 \cdot v^{-0.088} \cdot s^{0.472} \cdot a^{-0.054} \cdot r^{-0.013} \cdot \chi^{-0.418} \qquad 1$$

$$Rz = 241.808 \cdot v^{-0.088} \cdot s^{0.448} \cdot a^{-0.054} \cdot r^{-0.01} \chi^{-0.417} \qquad 2$$

3. THE ANALYSIS OF OBTAINED RESULTS

With the definition of income and outcome sizes, choosing of adequate methods for measure and apparatus measurement, the analysis of income sizes in depended, changed, choosing the function way for definition of experiment space, application of experiment, statistics process of researched sizes, and verification of mathematics models, is determined the influence of appropriated sizes, (v, s, a ,r & χ) in processed roughness surface.

In creasing the rear angle, the processed of roughness surface is decreased as a result of contact reduce of rear side of tool with the processed piece.
Reducing the cutting-Angle the height of micro elevated is reduced because there are reduced the plastic deformations of cutted stratum.

The cooler means and lubrication influenced in reducing of micro elevated of processed surface, as a result of reducing the friction force.
The obtained surface shape during the cutting process, is a result of movement of tool through the processed piece, will depend by the deformation caused by removing the scrap from the processed piece: Friction, consumption of tool, temperature as well as dynamic manifestations which are in the system: Machine, equipment processed piece and tool.

In a cutting process is impossible to obtain an ideal flat surface processed exactly. The processed surface has more or less avoid ness or mistakes from the shape given in a drawing (sketch).
The geometrical avoid ness gives disproportion of real surface of real profile with the given shape of geometrical surface or geometrical profile.
The realization of experimenting ad analytical researches, enable to bring the evaluations and ascertainment that, due too the complex and difficult conditions which is developing the process removing the scrap, is essential need the definition of the surface roughness processed.
The researched sizes should appear with the adequate mathematics model, where are the possibilities to so the differences of physical processed surface.
The obtained results during the experimenting are given in schedule 2, with metal processing obtained during the experimenting, is obtained the mathematics model (1 and 2). The graphic interpretation of mathematical model (1 and 2) is given in schedule 1.
The obtained results during the process, tells that except the cutting-regime a great influence in the surface roughness processed have: Hardness, Resistance, chemical-structural composition of processed piece.

4. CONCLUSION

The statistic analysis of mathematical models, confirms the right solution of the function shape, where appears the physical researched manifestation of manufacturing process with the scrap removal, and technological effects in the processed surface.
From the Mathematical models (1 and 2) ad their graphic interpretation we conclude that:

- The cutting speed (v) is a parameter which more or less depends from the quality of processed surface, increasing the cutting-speed, the roughness of the processed surface is reduced.
- By researching is confirmed that increasing a cutting-step (s) the parameters of the roughness processed-surface is increased.
- The cutting-deepness (a) has a small influence in the parameters of processed surface roughness, the influence of cutting-deepness in a proportion with other influenced factors is not important.
- Increasing the ray of roundness (r) and decreasing the attack edge (χ) the roughness of processed surface is decreased.

5. REFERENCE

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