RESEARCHES CONCERNING THE ROUGHNESS SURFACES BY OLC45 PROCESS THROUGH COLD SUPERFICIAL PLASTIC DEFORMATION

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Abstract: The aim work is analyzed influential technological parameters about roughness surfaces of the pieces from OLC45, pursuant to process through cold superficial plastic deformation. For modeling of used date the matrix model.

1. INTRODUCTION

The cold superficial plastic deformation of the metals is the process of remake innards, without detachment of scrapings, produced below action pressure and movement on these surface one or more tool without edges cutting, between the tool and the perform existing a relatively motion of his rotation of translation.

DPSR actuate merely about the layer from exteriorly the part process. This property the layer appreciate through size of the nature the physics, chemicals and mechanics what produced temporally exploitation of the organs of machine, through the features micro-geometrics on the surface, through the structural changes and through the remnant stress from his table. As much as part as the passive methods, quotients and to one active, the initial effect about surface process is a trace of a tool (the mark), carry then transformed in a trickles of what marks cover his partial this total the surface.

The finish surfaces of metallic part, through cold plastic deformation are based on the movement of superficial layer principle of the metal, below action the forces of pressure, from the prominent zones, to toward produce equalization, respectively standardize it a surface

Thus, is enforced the of a charterage different attentions of the mode of drive the process, when you wanted the procurance micro-geometrics enforced.

Here are the objectives, which are aimed at in this experiment:

- to establish the influence of the technological parameters on the roughness surface;
- to establish the interactions among factors;
- to establish a model which characterizes the process, is written in a matrix form.

2. SELECTION OF THE TESTED FACTORS AND VALUES

From all the factors, which may influence the feedback level, 4 factors have been chosen for the experiment, which, are presented below, each of them being tested at two levels of different values.

Table 1. The factors and levels of test

The code of the parameter	The factor of test	Level 1	Level 2	Unit of gauge
		-1	+1	
l	The amplitude of the oscillations	0,65	3	mm
n	Revolutions per minute	80	315	rot/min
f	The Feed by ED	0,024	0,132	mm/rot
P	Force of deformation	10	30	daN

3. ESTABLISHING THE TYPE OF EXPERIMENT

It is a complete orthogonal factorial experiment of the 2^n (2^4 = 16 attempts) for which the Yates algorithm is used in order to establish the research points.

Table 2. The experimental plane

Number of testing	Factors of tried				Roughness surface Ra [μm]
	l	n	f	P	OLC45
1	+	+	+	+	2
2	+	+	+	-	1.09
3	+	+	-	+	1.59
4	+	+	-	-	1.67
5	+	-	+	+	1.77
6	+	-	+	-	1.23
7	+	-	-	+	2.22
8	+	-	-	-	2.26
9	-	+	+	+	2.16
10	-	+	+	-	2.75
11	-	+	-	+	1.39
12	-	+	-	-	1.33
13	-	-	+	+	1.14
14	-	-	+	-	1.18
15	-	-	-	+	2.46
16	-	-	-	-	1.98

The interpretation of the factor effects is easier if the model, which characterizes the process, is written in a matrix form.

$$Ra_T = M + l + n + f + P + l*n + l*f + l*P + n*f + n*P + f*P \qquad (1)$$

or

$$Ra_T = M + \begin{bmatrix} E_{l1} & E_{l2} \end{bmatrix} \cdot l + \begin{bmatrix} E_{n1} & E_{n2} \end{bmatrix} \cdot n + \begin{bmatrix} E_{f1} & E_{f2} \end{bmatrix} \cdot f + \begin{bmatrix} E_{P1} & E_{P2} \end{bmatrix} \cdot P +$$

$$+ {}^t l \cdot \begin{bmatrix} I_{l1n1} & I_{l1n2} \\ I_{l2n1} & I_{l2n2} \end{bmatrix} \cdot n + {}^t l \cdot \begin{bmatrix} I_{l1f1} & I_{l1f2} \\ I_{l2f1} & I_{l2f2} \end{bmatrix} \cdot f + {}^t l \cdot \begin{bmatrix} I_{l1P1} & I_{l1P2} \\ I_{l2P1} & I_{l2P2} \end{bmatrix} \cdot P + \qquad (2)$$

$$+ {}^t n \cdot \begin{bmatrix} I_{n1f1} & I_{n1f2} \\ I_{n2f1} & I_{n2f2} \end{bmatrix} \cdot f + {}^t n \cdot \begin{bmatrix} I_{n1P1} & I_{n1P2} \\ I_{n2P1} & I_{n2P2} \end{bmatrix} \cdot P + {}^t f \cdot \begin{bmatrix} I_{f1P1} & I_{f1P2} \\ I_{f2P1} & I_{f2P2} \end{bmatrix} \cdot P$$

Therefore, as per gived numerical the model becomes:

$$Ra_T = 1.8538 + \begin{bmatrix} 0.255 & -0.255 \end{bmatrix} \cdot l + \begin{bmatrix} -0.3825 & 0.3825 \end{bmatrix} \cdot n +$$

$$+ \begin{bmatrix} -0.1612 & 0.1612 \end{bmatrix} \cdot f + \begin{bmatrix} -0.2937 & 0.2937 \end{bmatrix} \cdot P +$$

$$+{}^{t}I\cdot\begin{bmatrix}-0.2487 & 0.2487\\ 0.2487 & -0.2487\end{bmatrix}\cdot n+{}^{t}I\cdot\begin{bmatrix}-0.145 & 0.145\\ 0.145 & -0.145\end{bmatrix}\cdot f+$$

$$+{}^{t}I\cdot\begin{bmatrix}-0.195 & 0.195\\ 0.195 & -0.195\end{bmatrix}\cdot P+'n\cdot\begin{bmatrix}-0.0225 & 0.0225\\ 0.0225 & -0.0225\end{bmatrix}\cdot f+ \qquad (3)$$

$$+'n\cdot\begin{bmatrix}0.0875 & -0.0875\\ -0.0875 & 0.0875\end{bmatrix}\cdot P+'f\cdot\begin{bmatrix}-0.1687 & 0.1687\\ 0.1687 & -0.1687\end{bmatrix}\cdot P$$

For an estimate a relative effects of the factors it is comparate the him effect. This interpretation of results is facile if those are transferable under form of chart in which are indicate the effects of the factors and interactions among they what is presentated in fig. 1.

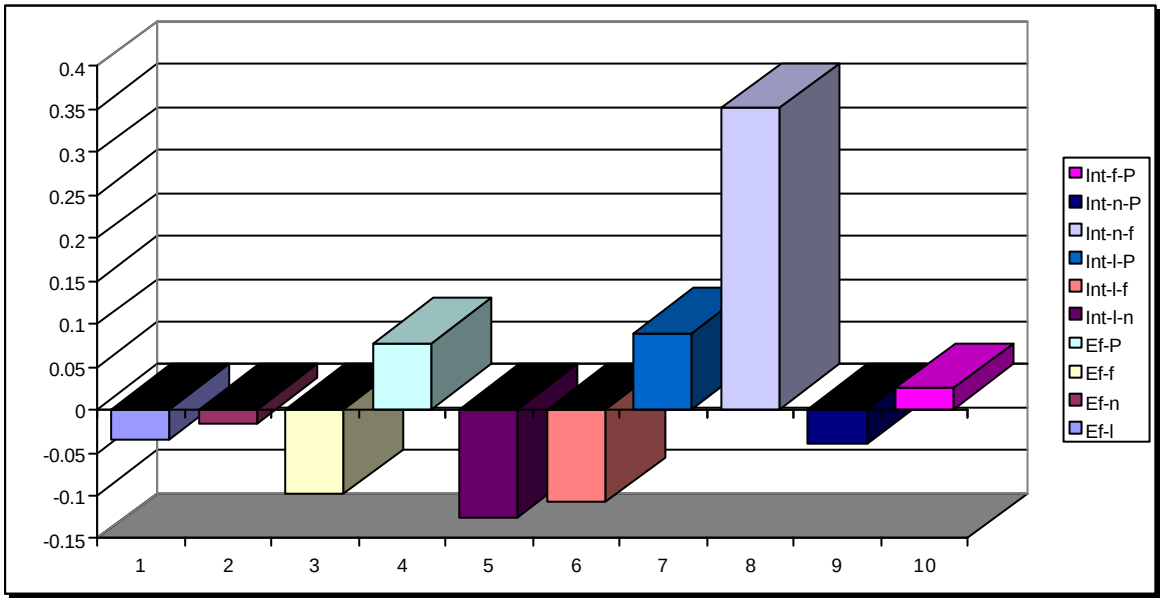

Figure 1 The chart of the effects and interactions at level 1 for OLC45

A mathematical model can enter abbots in report with average values realized from experiments, with the calculating values with equation of regressive the model and residual abbots.

Table 3. The aria of analyses

The source	The variable	The degree	The dispersions	F	f_α α=75%	The significance
l	S_l = 1.0404	1	V_l = 1.0404	1.33	1.69	Insignificant
n	S_n = 2.3409	1	V_n = 2.3409	2.99	1.69	**Significant**
f	S_f = 1.380625	1	V_f = 1.380625	0.53	1.69	Insignificant
P	S_P = 0.00950625	1	V_P= 0.00950625	1.76	1.69	**Significant**
l*n	S_{l*n} = 0.990025	1	V_{l*n} = 0.990025	1.26	1.69	Insignificant
l*f	S_{l*f} = 0.3364	1	V_{l*f} = 0.3364	0.43	1.69	Insignificant
l*P	S_{l*P} = 0.6084	1	V_{l*P} = 0.6084	0.77	1.69	Insignificant
n*f	S_{n*f} = 0.0081	1	Vn*f = 0.0081	0.01	1.69	Insignificant
n*P	S_{n*P} = 0.1225	1	V_{n*P} = 0.1225	0.15	1.69	Insignificant
F*P	S_{f*P} = 0.455625	1	V_{f*P} = 0.455625	0.58	1.69	Insignificant
Rez.	S_R = 0.780395	11	V_R = 0.780395			
Total	S_T	16				

Analyzed equation of regressive results from the calculus presupposes the determination of nameable abbots. Analyzed and the of a validation the model presupposes the settlement parameters and actions significantly through the utilization of the test Fisher(Snedecor).

The tabular value of the Fisher test is taken from the table depending on the number of the liberty degrees. The checking and the order of the influencing factors according to the Fisher criterion is presented in table 3.

4. CONCLUSIONS

For material OLC45 is shall obtained a value diminished a proper roughness surface process if the amplitude of the oscillations is to the level 1, the revolutions per minute to the level 1, the feed of the element of the distorter to the level 1 and force of deformation to the level 2.

Also, noticed as for a risk of 25% just the interaction among revolutions per minute and the feed of the element of the distorter can be envisaged. At that rate the matrix model proposed (3), they get the form:

$$Ra_T = 1.8538 + \begin{bmatrix} -0.3825 & 0.3825 \end{bmatrix} \cdot n + \begin{bmatrix} -0.1612 & 0.1612 \end{bmatrix} \cdot f + \begin{bmatrix} -0.2937 & 0.2937 \end{bmatrix} \cdot P \quad (4)$$

Remarked the fact as the interactions among factors this time don't present a strong effect. Between revolutions per minute and the speed of feed of the element of practical distorter don't exist the interaction. Also, interaction among revolutions per minute and forces of deformation has an effect near a null.

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