ANALYSIS OF THE ASPECTS RELATED TO THE HARSHNESS OF THE SURFACES OBTAINED BY VIBRO-ROLLING

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ABSTRACT: There are established methods for realizing manufacturing through vibro –rolling of the exterior surfaces. On the duration of the experiments, proposals of improving the vibro –rolling devices performances have been analyzed and formulated based on constructive new solutions.

1.INTRODUCTION

Estimation of the harshness based only on certain theoretical methods is a difficult task and the results obtained do not correspond to the reality if they are not correlated to experimental trials. For the analysis of the harshness of the vibro-rolled surfaces according to the parameters of the processing, experimental measurements have been carried out using the equipment based on the device for measuring the harshness HV10.

The parameters with major implications in the evolution of harshness have been considered as the revolution (rotation) of the machine part (n), the pressing force (F) and the advance (so). In order to study the effects of the frequency (f) and of the amplitude (A), the measurements have been carried out for two frequencies and three different amplitudes. With the aim of observing the influence of the processing parameters upon the harshness achieved by vibro-rolling, experiments have been made with three types of steel, 18MoCr10. The experimental results for the 18MoCr10 steel are given in figure 1,2,3

For analyzing the experimental results and in order to define certain mathematical relations which to describe the results in a compact form the approximation of these was made with the aid of the least squares method, using polinomial functions.

Processing the results was made as a numerical form with the aid of a program (“diag_tehno”) achieved within MATLAB environment, using the functions “polyfit” and “polyval”.

The “polyfit” function calculates the coefficients of the polynom of 3-rd degree which approximates in the sense of the least squares the set of experimental data, whereas the “polyval” function calculates the set of approximate values using the coefficients already obtained.

2. EXPERIMENTS

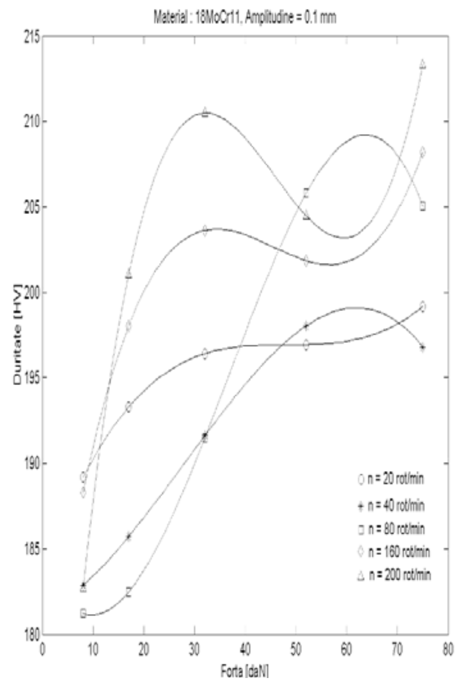
For each set of experimental data the harshness variation diagrams and the depth o the deformed stratum were drawn and conclusions were formulated on the observed phenomena.

The results of the experiments on the influence of the pressing force, for different rotation speeds upon the evolution of the harshness is presented in figure 1 in the case of and amplitude of A= 0.1 mm, figure 2; the case of and amplitude of A= 0.2 mm and figure 3 in the case of and amplitude of 0.25.

The data presented in the tables were displayed graphically in the diagrams in figures 1,2 and 3 with the help of the above-mentioned program.

In figures 1.a 2.a and 3a there are presented the bi-dimensional diagrams, whereas in figures 1b, 2b and 3b there are shown the tri-dimentional representations of the results.

The evolution of the harshness according to the parameters of the process Steel: 18MoCr10, f = 35Hz, A= 0.1 mmm so = 0.05 mm/rot, the graphical representation of the results given in figure 1.



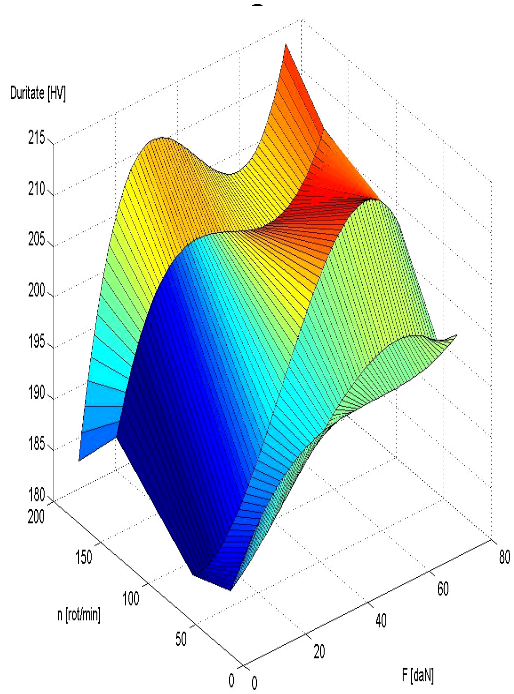
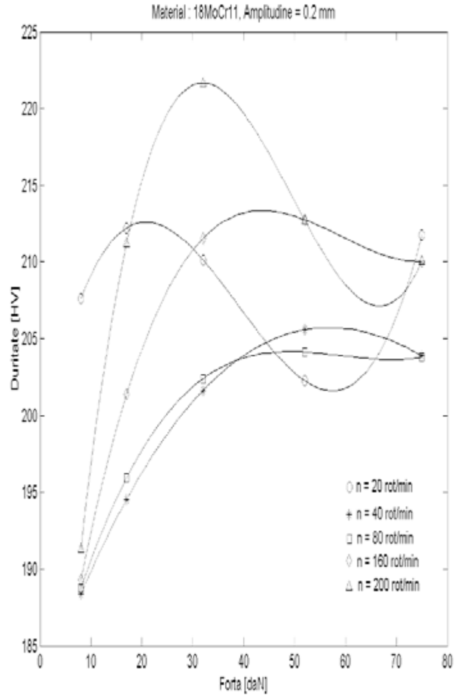


Figure 1. The graphical representation of the harshness according to the parameters of the process Steel: 18MoCr10,



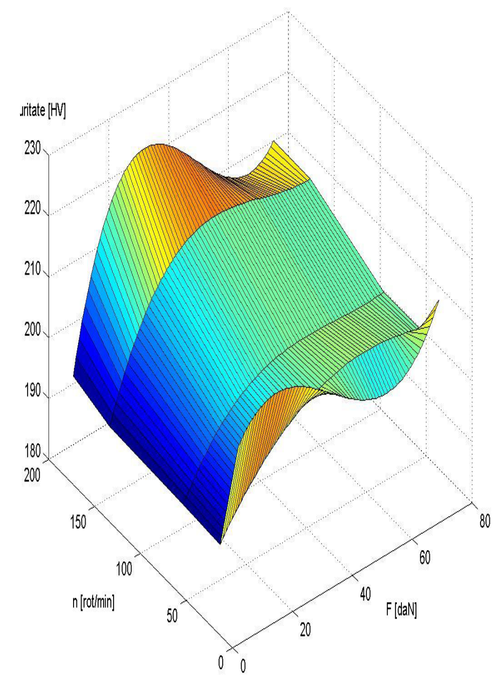


Figure 2. The graphical representation of the results and the evolution of the harshness according to the parameters of the process Steel: 18MoCr10, f = 35Hz, A= 0.2 mm so = 0.05 mm/rot

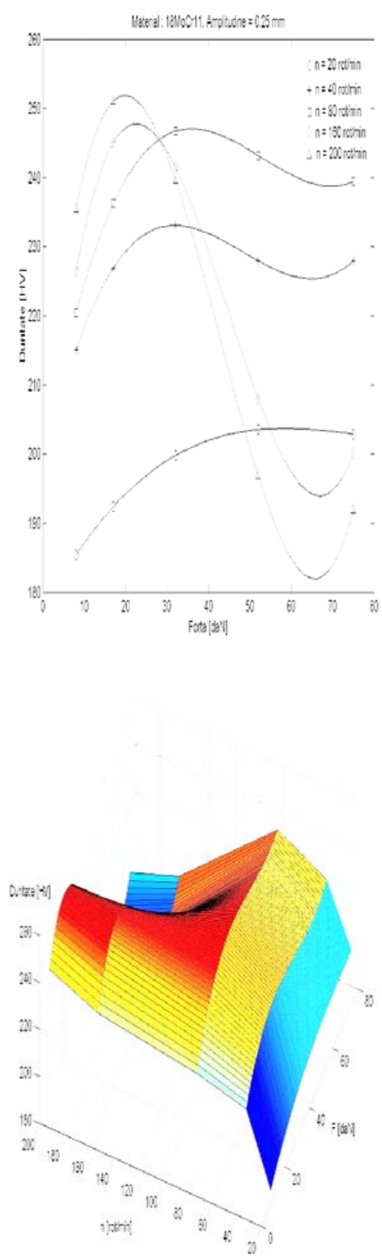


Figure 3. The graphical representation of the results and the evolution of the harshness according to the parameters of the process Steel: 18MoCr10, f = 36,4Hz, A= 0.25 mm so = 0.05 mm/rot

Of the results presented the following conclusions can be drawn:

- the maximum values of the harshness can be obtained for:
  - high revolution [rotation/turn] (100-200rot/min) and low pressing forces (up to 20 daN);
  - low revolution [rotation/turn] (up to 80 rot/min) and high pressing forces (60-70 daN);
- the increase of the pressing force has an influence in the sense of the increase of harshness only for small revolution [rotation/turn] (up to 80-90 rot/min);

- the increase of amplitude in the conditions of the constant maintenance of the advance and the frequency implies a uniformization of harshnesses on vast domains, excepting the area of the high revolution [rotation/turn] and forces;
- it is possible that for the area of the high revolution [rotation/turn] and forces phase transformations of the microstructure to take place, leading to a decreased harshness of the surface;

The domains of the chosen parameters for the experiments carried out are limited by the functional characteristics of the vibro-rolling installation.
The experiments carried out demonstrate that the methods used for the analysis of the influence of technological parameters on the characteristics of the surfaces obtained are correct and can be used also in the case of more ample experiments when the material resources allow this. By achieving a more performant vibro-rolling installation the domain of experimentations can be extended and larger volumes of data can be obtained, thus enabling a more precise evaluation of the influences studied.

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