ECONOMIC EFFICIENCY OF THE DEPOSITS, IN THIN FILMS, ON THE KNIVES MADE OF METAL CARBIDE

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Abstract. *The most relevant way to present how the deposits made through the Magnetron method, improved the knives efficiency, is to follow through experimental researches, the processing cutting length. The knives reach a certain value of wear, because in the industrial processes is considered a knife is used, when the quality of machined surfaces and edges decreases. Cracks and stone chips, for the ennobled panels of PAL and MDF, or tears and snatching of material for the wood products, through the experimental research, are observed.*

Keywords: *MDF panels, vacuum deposition, metal carbide, thin film, Magnetron method.*

1. INTRODUCTION

The studies and the experimental researches, realized within this work, can continue in a program in country or outside. The vacuum depositions technologies, in thin films, as commonly used in many areas outside the country, lately, arrived to be used in the country, on an industrial scale.
It is mentioning the concern of some laboratories from universities that acquire and experience in these types of installations [2]. In Europe, is observed, in particular, the interest of the producing furniture and wood products firms, or wood-based, testing for the study of behavior (in the labs of the universities) cutting tools produced by these technologies, analyzing the economic efficiency, the main parameter to promote these technologies [3].
In the U.S. there is a tendency for manufacturers of cutting tools to explore and experiment in the laboratories of universities, where the costs are lower and for the efficient technologies, which give good economical results, to handle development of the technologies and the products for placed on an industrial scale.

2. STUDIES AND EXPERIMENTAL RESEARCHES

The most relevant way to present how the deposits made through the Magnetron method, improved the knives efficiency, and is to follow through experimental research, the length cutting processing. The blades reach a certain value of wear, because in the industrial processes is considered a knife is used, when the quality of machined surfaces and edges decreases. Cracks and stone chips, for the ennobled panels of PAL and MDF, or tears and snatching of material for the wood products, through the experimental research, are observed.
As shown in the multiple determinations obtained by experimental tests, assess wear after machining process (milling) the deposited layers (Zr), (ZrN), (CrZrN) raised the performance carbide metal knifes:

- the best behavior had the knife with (ZrN) deposit, which can process 4 times greater lengths than conventional knifes for the same wear;
- on the second place is the knife with (Zr) deposit, which can process 3 times greater lengths than the cage knives;
- the largest wear has the knife with (CrZrN) deposit which improved, but insignificant, the performances of the ordinary knife, so it is economically inefficient for the industrial applications.

Figure 1. The semi-finished during the cutting process

For further research is interesting the experimental tests continuity, with changing the deposition process parameters, this paper is only a beginning, taking into account the laboratory where the deposits were obtained, the experimental tests (Figure 1) were performed for ten years, in various deposition conditions for obtaining thin (Cr) layers.
This laboratory is equipped at Cluny France University, where students, masters and doctoral students come to specialization, from many countries [5].

The laboratory tests were more intense than the demands of cutting processes made in the industry, in production, because the tool holder body was equipped with a single cutter knife. The other was mounted just balancing and therefore the entire process of cutting was performed with a double application.

Because of the operating mode to determine the wear, at equal distances of processed 100 [m], were milled in 50 [m] of each time without interruption. In the normal industrial processes, the length of working for a benchmark is 1 [m] and 2.5 [m).

The total processed length to determine the wear of 1000 [m] for each knife is higher than the use average of a knife in industry: (150 ~ 400) [m], depending on the processed material and the parameters of the cutting process), obtaining relevant results to the behavior of the knifes that has been vacuum-deposited in thin layers (Zr), (ZrN), (CrZrN).

The processing length of 1000 [m], which has been used to determine the wear, allowed us to obtain useful results immediately applicable for:

- industry, on the grounds of quality of surfaces and edges resulting from the cutting processes; the processed lengths are much smaller - for furniture, the MDF and PAL landmarks, ennobled or natural can present defects in macroscopic scale, which are determined visually, for example stone chips and cracks; the occurrence of these defects the knives are spent and replaced.
- research - this is the reason for the continued determination of the wear till processing lengths of 1000 [m], and even more, in order to have a complete image on the behavior of the studied materials [1].

In the graphs which are drawn up (Figure 2) for the wear of the knives on the processed length, it may happen, that for some materials, the corresponding curves drawn to intersect after some hundreds or thousands of processed meters, which means that after that limit value the trends of behavior are reverse.

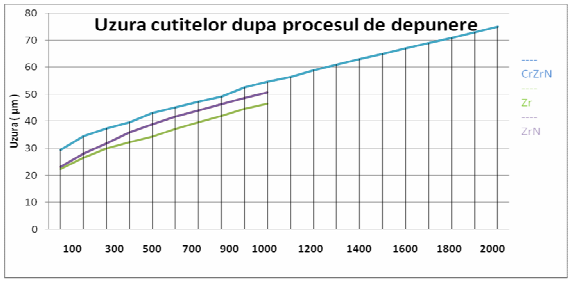

Figure 2. Comparative *wear* for materials deposited in thin layer

It follows that the material was first a pronounced wear, after that value of the processed length, would have a less wear than the other material).

3. ECONOMIC EFFICIENCY AS RESULT OF THE EXPERIMENTAL TESTS ANALYSIS

In the Figure 3 to track, comparatively, the processing length of the knives after which they reached a certain value of the wear, taking into account that abscissa represents the processed length [m], and on ordinate, the wear knife [µm], lengths of processing for a wear value building a horizontal line (through the value of the wear) are obtained. The horizontal line, constructed for a wear value of about 47 [µm], corresponds to a processed length of:

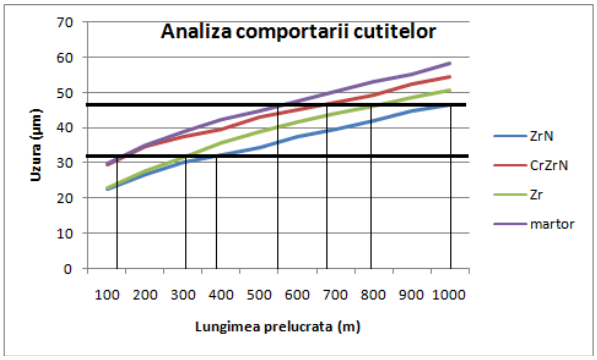

Figure 3. Efficiency of the modified knives against the control knife

- 500 [m] for the control knife;
- 950 [m] for the (ZrN) deposit knife, which has a twice efficiency against the control knife;
- 750 [m] for the (Zr) deposit knife, which has an efficiency of 50 [%] higher than the control knife;
- 625 [m] for the (CrZrN) deposit knife, which has an efficiency of 25 [%] higher than the control knife.

Significant results are observed for processing lengths in the range (0 ~ 400) [m] of interest to industrial fabrication - corresponding to the horizontal line for a value of the wear of ~ 32 [µm].

- the control knife, industrial product after processing of 80 [m], already has a wear 30 [µm];
- the knife with (ZrN) deposit, reach the same value of wear 32 [µm] after 340 [m], that is a processed length higher four times;
- the knife with (Zr) deposit, reach the same value of wear 32 [µm] after 250 [m], that is a processed length higher three times;
- the knife with (CrZrN)deposit, has a better behavior, but insignificant compared to the control knife.

The knives with (Zr) and (ZrN) deposits are viable solutions for the applications in the industrial processes and they are economically efficient, because it can process lengths (3-4) times higher than cage knives are replaced by (3-4) or less, avoiding lost time for these operations.

Should be noted that in the industrial processes during the replacement of a knife consists of many operations, of which the most important are: stopping the machine, effectively replacing used with the new knife, setting new knife shaft tool holder , installing or fixing drawer tool (numerical command machines), start the machine and trying new knife [4].
Finally, the price of the improved knife is about 20 to 30 [%] greater than the normal one having regard to the price of the knife / [m] processed, the results are in favor of improved processes for length of 3-4 times higher.

4. CONCLUZIONS

Based on the experience gained during the experimental researches and contacts with the external mobility opportunity, it outlines some experimental research directions with the cutting regime and relationship-processing material cutting tools: thus, can perform behavioral tests of the knives after the deposition process in thin-layer for the manufacture of solid wood (hardwood, softwood), MDF and PAL ennobled particularly by melamine coating, in order to determine the quality of the machined surfaces. It know from the industry, that for these materials based on wood, the knives should be replaced quickly, because cracks appear after snatching and machining [6].
Choosing installations, devices and representative measuring equipment, with recognized functional characteristics, where the phenomenon of wear requires most important technical and economical solutions, reflects the authors' concern to achieve results consistent with the current concerns of specialists and producers in the field.
The proof in these regard observations, laboratory analysis, processing the results and proposed alternative solutions, ensuring efficient operation of the equipments of the laboratories ENSAM Cluny University in France.

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