EXPERIMENTAL STUDY OF CUTTING PROCESSABILITY USING FACTORY METHODS

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ABSTRACT: The paper highlights that cutting property is a complex notion that in essence can be determined by the way in which the semi-manufactured product uses the cutting tool. The durability (T) of the cutting tool is considered to be one of the most convenient indicators for establishing the processability. As it is well known, the rising levels of wear are big cutting tools and time consumers (because of the wear curves rising to different constant speeds). For accelerating the measurements faster and shorter methods with a minimum use of cutting tools must be applied, even though they have a wider distribution of results (these methods are called factory methods). The paper presents two factory methods: frontal turning method and longitudinal turning method by gradually increased speed. The following processability indicators were used for these methods: the speed that corresponds to certain durabilities ($v_{15}$) and the compatible speed ($v_{comp}$).

KEYWORDS: tool’s durability, wear characteristics, durability diagram – speed, processability indicators, factory methods.

1 INTRODUCTION

1.1 Theoretical considerations regarding cutting processability

The cutting processability or the cutting property of materials is a concept whose definition is not completely standardized. Processability is a complex notion which can be considered the sum of the problems and difficulties shown by a certain material when its shape is modified through cutting [5], [6].

Considering all properties that define a material and that influence its cutting processability could lead to a more exact assessment of this characteristic. However, it would require an extremely big amount of data, which is not always available. Cutting processability is basically influenced by the metallurgy, development, chemical composition, thermic treatment, surface state of the semi-manufactured product etc. At the same time it is also influenced by the cutting tool, its material and geometry, by the cutting regime, the tool’s fastening mode and by the machine-tool [1], [3].

Establishing the processability of a material requires deep knowledge of all factors that lead to an efficient cutting process but also of high quality products.

A material is more processable if the durability of the cutting tool is greater, the time in which the removal of the volume unit from the processed material is smaller, the quality of the resulted surface is better, the mechanical and thermic work of the tool is reduced and the processing precision is higher.

Evaluating the processability is done by combining the data that describes the mechanical and technological properties of the material and the results of specific practical tests. The conclusions regarding the cutting property of the materials are available in a wide enough fields such that they cover all practical cutting conditions.

Excessive use of mechanical properties, such as resistance and/or durability, can not lead to a correct assessment. The processability is influenced by many factors such as: the chemical composition, the structure, inclusions and alloying elements properties etc. Nevertheless a good processability is also determined by using a certain tool, which under different conditions, could lead to completely unsatisfying results for another material.

1.2 Theoretical considerations regarding tools wear

The wear of the cutting tool consists in the material transport from the active tool surfaces (rake surface $A_A$, main clearance surface $A_\alpha$, auxiliary clearance surface $A_\alpha'$) which leads to the modification of the edge geometry and the gradual loss of the tool’s cutting capacity. The conditions under which this phenomenon is produced are: high contact pressure, high temperatures and the relative movement between the surfaces in contact [3], [5].

According to the cutting part’s surfaces disposal, the following types of tool wear can be distinguished (figure 1):
Wear of the main clearance surface—can be assessed using the width of the detachment wear, represented by VB, which is sensibly uniform and easy to measure. At the intersection between the main edge and the surface of the tool to be processed we often find ridge-shaped wear, caused by the erosive effect of the tool’s superficial layer, which usually has a higher durability.

Wear of the rake surface—its most characteristic type is the crater-shaped wear, while its parameters are: KT – the depth of the crater, KM – the distance from the tool’s edge to the center of the crater (measured perpendicular on the edge of the tool), KB – the width of the crater, KL – the distance between the edge of the tool to the origin of the crater (the crater’s lip).

Wear of the secondary clearance surface—it’s characterized by the width of the detachment wear, represented by VA, and it is valuable to the finishing process, because it influences the quality of the processed surface. The direct evaluation of this wear is very difficult, however its effect can be established indirectly by measuring the rugosity.

As a result of the wear process evolution, the geometry of the edge is modified and it slightly loses its cutting capacity. The main assessment parameters of the cutting tools wear are standardized and shown in figure 2. Basically their size represents the dependent variables in the experimental studies regarding the cutting tools wear evolution.

According to the objectives of the study, the independent variables can be elements of the cutting regime, edge angles, properties of the tool’s or semi-manufactured product’s material etc.

Any experimental study regarding the wear of the cutting tools requires raising the wear property. This characteristic (figure 2) represents teh evolution of an wear assessment parameter in time.

By comparing two or more wear characteristics raised under the influence of a single influence factor can establish the way in which they affect the tool’s reaction to the wear process.

In order to raise the wear characteristic the cutting process must be periodically interrupted. The worn surface (VB) of the main laying surface is measured with the help of a microscopic device attached to the tool holder.

A more rigorous method uses multiple tools from the same fabrication batch, identically made which are used to cut the same material under identical cutting conditions in different time intervals. Afterwards, the wear parameter of each tool is measured and the pairs of wear – time values are represented graphically (as the example in figure 2). The curve obtained is denoted as wear characteristic. The shape of this characteristic is subject to the influence of the different factors that affect the wearing process.

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For establishing by experiment the influence of the cutting speed over the durability of the edge (T), we cut at different speeds and we establish the durabilities (figure 3). By representing the pairs of
values $T_i$ as double logarithmic coordinates we obtain the diagram in figure 4. This diagram corresponds to a pair of materials tool – piece, to a single combination of variables depth ($t$) – advance ($s$) and obviously to a single value of the established wear limit. It can also rise in case of the occurrence of another factor, for example the advance $s$.

In a domain that corresponds to the usual cutting speeds, the durability – speed curve can be approximated with a straight line having the following equation (1):

$$\log T = \log C_T + k \cdot \log v$$  \hspace{1cm} (1) \hspace{1cm} \text{whose slope is:}$$

$$k = tg\Omega = \frac{\log T_A - \log T_B}{\log v_A - \log v_B} < 0$$ \hspace{1cm} (2)

The relation (1) can be written as:

$$T = C_T \cdot v^k$$ \hspace{1cm} (3)

known as Taylor’s equation. This relation can be used in its inverse form:

$$v = C_v \cdot T^m$$ \hspace{1cm} (4) \hspace{1cm} \text{in which} \hspace{1cm}$$

$$C_v = C_T^{\frac{1}{k}}$$ \hspace{1cm} (5)

$$m = \frac{1}{k}$$ \hspace{1cm} (6)

The constants $C_T$ și $C_v$ from the equations (3) and (4) represent the durability of a unitary speed, respectively the speed of a unitary durability.

The exponent $k$ is a synthetic indicator of the tool’s material wear responsivenes. A great exponent $k$ as an absolute values indicates a big slope and a big variation of the tool’s durability for a small cutting speed variation. A tool is generally exploited at different cutting speeds, therefore it is important that its influence over the durability is as low as possible, meaning the exponent $k$ has the smallest absolute values.

The influence of the cutting speed and of the advance over the wear of the tool is mainly the same: as they rise, the slope of the wear - time curves rises (figure 3). However, increasing both the speed and the advance at the same rate, the slope of the curve rises in the first case more pronounced than in the second one, which means that the speed of the cutting process has a bigger influence over the durability than advance. The smallest influence over the wear comes from the cutting depth. For tools made of metal carbides materials or ceramic materials it has no practical value. From this point of view, the order of establishing the cutting regime parameters will be: the depth $t$, the advance $s$ and the speed $v$.

2 CRITERIA FOR ASSESSING THE CUTTING PROCESSABILITY

For assessing the cutting processability of a material, 2 criteria are frequently used [4], [8], [9]:

• Criteria of processability $Z_v$ is based on the evolution of the wear curves (or durability) depending on the cutting speed;

• Criteria of processability $Z_s$ is based on examining the cutting shape and the rugosity of the processed surface.

If the $Z_v$ criteria assesses the cutting property of the material through the wear induced on the cutting tool, the $Z_s$ criteria depends on the rugosity of the processed surface, the apparition of deposits and the shape of the detached chip.

The processing indicators characteristic to the $Z_v$ criteria, calculated with the Taylor formula ($T = C_T \cdot v^k$) are of the following types:

• $v_{60B0.3}$ is the speed for which after 60 minutes of cutting, a wear $VB = 0.3 \ mm$ appears on the laying surface;

• $v_{60K0.1}$ is the speed for which after 60 minutes of cutting, a craterial wear characterized by the ratio $K = KT/KM = 0.1$ appears on the detachment surface of the tool

• $v_{60}$ is the speed for which after 60 minutes of cutting under precise working conditions, the tool reaches a catastrophic wear.

Obtaining these indicators – which are cutting speeds that during a time interval and under predetermined cutting conditions cause the formation of a predetermined wear – is suggestively represented by figure 5.
FACTORY METHODS FOR PROCESSABILITY ASSESSMENT

The durability of the tool \( T \) is considered to be one of the most convenient indicators for assessing the processability. For establishing the durability by experiment we need expensive and time-consuming tests, as well as higher experiments standardization, starting with a rigorous control of the semi-manufactured products materials and the tools materials, as soon as intercepting them.

Trying to establish the durability is very time consuming due to the rise of the wear curves at different constant speeds. For accelerating the measurements we use faster and shorter methods such as the frontal turning method or longitudinal turning method by gradually increasing speed \([5], [6]\).

### 3.1. Frontal turning method.

This method requires the frontal turning of a test tube in shape of a disk provided with a frontal reaming (figure 6). The turning is performed starting from the center to the margin, while measuring the radius \( R_u \) for which the maximum admissible wear appears, corresponding to a certain speed. The experiment is repeated for a large set of revving values such that \( n_{\text{max}}/n_{\text{min}} > 8 \), establishing each time the diameters corresponding to the moment the tool reaches the limit wear.

Using these values we build a diagram with the double logarithmic coordinates \( n - R_u \) (figure 6) and we calculate the value of the straight line’s slope used to approximate this dependency \( \tan \alpha \). Knowing this value we can find the value of the exponent \( m \) (by using Taylor’s formula written as \( v = C_v \cdot T^m \)) as well as the following formula:

\[
\frac{m}{1 + \tan \alpha / \tan \alpha - 1} \quad (7)
\]

The value of the constant \( C_v \) is determined by using the relation (8):

\[
C_v = \frac{2\pi \cdot R_u \cdot n}{1000} \frac{m}{\sqrt{s \cdot n \cdot (m+1)}} \quad (8)
\]

where:

- \( s \) \([\text{mm/rot}]\) is the feed rate (work advance);
- \( R_u \) \([\text{mm}]\) is the radius for which we get a maximum admissible wear;
- \( n \) \([\text{rot/min}]\) is the revving speed of the test tube.

Knowing the values \( C_v \) and \( m \) we can calculate the speed that corresponds to a certain durability as a processability indicator of this measurement method.
3.2. The method of longitudinal turning by gradually increasing speed.

The test tube used for this method (figure 7) has a cylindrical shape and it is divided into multiple sections of constant length $L_0$ established such that the trajectory left by the tool on the test tube is 25 m.

$$L_0 = 25000 \cdot s/\pi \cdot (D - 2 \cdot t)$$  \hspace{1cm} (9)

where: $D [\text{mm}]$ is the exterior diameter of the test tube; $t [\text{mm}]$ the cutting depth; $s [\text{mm/rot}]$ the work advance (feed rate).

The sections are each turned with speeds that belong to a geometric progression with ratio 1,12. The processing takes place until the destruction of the cutting edge. We require that the destruction takes place for the processing of the section with the serial number $z = 7 \pm 1$.

The processability indicator for this method is the compatible speed $v_{\text{comp}}$, which is determined using the following formula:

$$v_{\text{comp}} = v_{z-1} + (v_z - v_{z-1}) \cdot L_z/L_0$$  \hspace{1cm} (10)

where:

- $v_z$ is the cutting speed that corresponds to the section for which the destruction of the cutting edge was produced;
- $v_{z-1}$ is the cutting speed which corresponds to the last fully processed section;
- $L_z$ is the length of the cut path on the section where the destruction of the cutting edge was produced;
- $L_0$ is the length of a section.

The value of the compatible speed $v_{\text{comp}}$ is used as an assessment criteria for processability: a higher value means a better processability. The process however has limited applications and it is hard to apply it for carbide tools or mineral-ceramic materials.

The attempts for durability measurement that are based on the cutting path, for which rapidly increasing speeds were used have the advantage of a shorter interval of time, but they produce a wider distribution of results.

Fig. 6 Scheme of the frontal turning method and graphical processing of the experimental results [5]

Fig. 7 Scheme method of testing the processability by turning the speed increases in steps [5]
4 EXPERIMENTAL CONDITIONS REGARDING THE FRONTAL TURNING METHOD

The experiment was conducted using a SNA 560 turning lathe according to the methodology described in paragraph 4.1. As cutting tools, there were used six metal carbide turning tools, all having the same well defined geometry ($\chi_r = 70^\circ$, $\chi'_r = 10^\circ$, $\gamma_o = 6^\circ$, $\alpha_o = 6^\circ$, $\lambda_s = 0^\circ$, $r_e = 0.4$ mm), which frontally turned two steel disks (one OLC45 disk and another OL60 disk with a greater diameter provided with reaming) from the center to the margins (each disk 3 times) according to the conditions in table 1. The wear radiiuses $R_u$ obtained in the 6 experiments were measured using the caliper, such that they reach the same limit wears (catastrophic wear).

![Fig. 8 Flange from OLC45: a) initial; b) processed (note the three diameters where the maximum permissible wear is achieved: $2R_u1$, $2R_u2$, $2R_u3$)](image)

![Fig. 9 The turning tool made of brazed metal carbide insert (pasted): a) without wear; b) wear after the first experiment; c) wear after the second experiment; d) wear after the third experiment](image)

In figure 8 we can notice that the OLC45 flange fixed in the SNA 560 turning lathe’s universal (between the 3 tanks) before the experiment (Fig. 8a) respectively after the experiment (Fig.8b, when the 3 diameters with the highest maximal admissible wear on the tool can be measured on the flange).

In figure 9 we can observe the metal carbide turning tool before the experiment (without wear) respectively the tool after the experiment (worn). We can notice that the wear is approximately the same after each experiment (experiments 1, 2 respectively 3 in tabel 1)

**EQUIPMENT:** SNA 560 X 1000

**TOOL:** metal carbide (for steel), $\chi_r = 70^\circ$, $\chi'_r = 10^\circ$, $\gamma_o = 6^\circ$, $\alpha_o = 6^\circ$, $\lambda_s = 0^\circ$, $r_e = 0.4$ mm

**MATERIAL:** OLC45, OL60

**ENVIRONMENT:** air

**AMC:** caliper
Table 1 Technological parameters for conducting the experiment

<table>
<thead>
<tr>
<th>Mat</th>
<th>Exp.</th>
<th>t [min]</th>
<th>n [rot/min]</th>
<th>s [mm/rot]</th>
<th>Ru [mm]</th>
<th>log n</th>
<th>tg α</th>
<th>m</th>
<th>C_v [min]</th>
<th>T [min]</th>
<th>(v_{15} [m/min])</th>
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<tbody>
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<td>1</td>
<td>1</td>
<td>315</td>
<td>0,1</td>
<td>80</td>
<td>2,49831</td>
<td>3,31</td>
<td>135</td>
<td></td>
<td>15</td>
<td>17,78</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>1</td>
<td>500</td>
<td>0,1</td>
<td>63</td>
<td>2,69897</td>
<td>1,864</td>
<td>136</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>1</td>
<td>800</td>
<td>0,1</td>
<td>48,5</td>
<td>2,90308</td>
<td>134</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OLC60</td>
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<td>1</td>
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<td>0,1</td>
<td>105</td>
<td>2,49831</td>
<td>203</td>
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</table>

For the semi-manufactured product OLC45, we calculate the value of the straight line slope \((\tan α)\) using double logarithmic coordinates \((\log n - \log R_u)\), considering the attempts 1 and 3.

\[
\tan α_{1-3} = \frac{\log n_3 - \log n_1}{\log R_{u1} - \log R_{u3}} = \frac{\log 800 - \log 315}{\log 80 - \log 48,5} = 1,86235 \quad \rightarrow \quad α_{1-3} ≈ 61,7^0
\]

If we consider the attempts 1 and 2, we obtain:

\[
\tan α_{1-2} = \frac{\log n_2 - \log n_1}{\log R_{u1} - \log R_{u2}} = \frac{\log 500 - \log 315}{\log 80 - \log 63} = 1,934077 \quad \rightarrow \quad α_{1-2} ≈ 62,65^0
\]

If we consider the attempts 2 and 3, we obtain:

\[
\tan α_{2-3} = \frac{\log n_3 - \log n_2}{\log R_{u2} - \log R_{u3}} = \frac{\log 800 - \log 500}{\log 63 - \log 48,5} = 1,796849 \quad \rightarrow \quad α_{2-3} ≈ 60,9^0
\]

We can observe that the slope of the straight line is approximately the same, regardless of the attempts taken into account (attempts 1 and 2 or attempts 2 and 3, respectively 1 and 3), which proves the correctness of the experiment. We shall continue to work with a mean value of the slope, calculated as an arithmetic mean value, as follows:

\[
\tan α = \frac{\tan α_{1-3} + \tan α_{1-2} + \tan α_{2-3}}{3} = \frac{1,86235 + 1,934077 + 1,796849}{3} = 1,864425
\]

According to the bibliography [3], [5] we can deduce the formula used to calculate the exponent \(m\), which is part of Taylor’s formula:

\[
m = \frac{1 + \tan α}{\tan α - 1} = \frac{1 + 1,864425}{1,864425 - 1} = 3,3136
\]

The constant \(C_v\) from Taylor’s formula is calculated using the relation (8) in paragraph 4.1, for each particular attempt:

\[
C_v = \frac{2π \cdot R_{u1} \cdot n_1}{1000 \sqrt{\frac{R_{u1}}{S \cdot n_1 \cdot (m + 1)}}} = \frac{2π \cdot 80 \cdot 315}{1000 \sqrt{\frac{80}{0,1 \cdot 315 \cdot (3,31 + 1)}}}
\]

\[
= 158,33 \cdot \sqrt[3]{0,589253489} \approx 134,883183
\]
The mean value of the constant $C_V$ in Taylor’s formula is:

$$C_{v2} = \frac{2\pi \cdot R_{u2} \cdot n_2}{1000} \cdot \frac{m}{s \cdot n_2 \cdot (m + 1)} = \frac{2\pi \cdot 63 \cdot 500}{1000} \cdot \frac{3.3}{0.1 \cdot 500 \cdot (3.31 + 1)} = 197.92 \cdot \frac{3.3}{0.29234388} = 136,344982$$

$$C_{v3} = \frac{2\pi \cdot R_{u3} \cdot n_3}{1000} \cdot \frac{m}{s \cdot n_3 \cdot (m + 1)} = \frac{2\pi \cdot 48.5 \cdot 800}{1000} \cdot \frac{3.3}{0.1 \cdot 800 \cdot (3.31 + 1)} = 243.78 \cdot \frac{3.3}{0.14066125} = 134,545483$$

Knowing the values $C_V$ and $m$ we can calculate the speed $v_{15}$ that corresponds to a durability $T=15$ [min], as a processability indicator for this method. Another important aspect is the fact that the exponent $m$ in Taylor’s formula is negative and we have to take into account all measurement units such that the speed is expressed as m/min.

$$v_{15} = C_V \cdot T^m = 135,25 \cdot 15^{-3.3} \cdot 10^3 = 17.78 \text{ [m/min]}$$

We repeat the calculations for OL60 and we determine the indicator $v_{15}$. The values are written in tabel 1. By comparing the values of the processability indicator ($v_{15}$) for the 2 materials, we can draw the conclusion that OL60 is more processable with the carbide metal tool (having the previously established geometry) than the semi-manufactured product made of OLC45.

5 EXPERIMENTAL CONDITIONS REGARDING THE LONGITUDINAL TURNING METHOD BY GRADUALLY INCREASING SPEED

The experiment was conducted using the SNA 560 turning lathe, according to the methodology described in the paragraph 4.2. There were used two turning tools made of fast steel (Rp2) having the same well defined geometry ($\gamma = 90^\circ$, $\gamma' = 20^\circ$, $\alpha_o = 6^\circ$, $\lambda_s = -10^\circ$, $r_e = 0.4$ mm), which longitudinally turned two semi-manufactured cylinders (OLC60 and OL50) divided into 9 equal sections (of length $L_0$) according to the data in table 2.

The cut length $L_c$, on which the destruction of the cutting edge took place was measured using the caliper. Each experiment ended when the same tool wear limit was reached.

Fig.10 Cylindrical workpiece of 56 mm diameter OLC60, divided into equal length sections $L_0$, processed by cutting at different speeds, according to Table 2

In figure 10 we notice the cylindrical semi-manufactured product OLC60 ( divided in sections of length $L_0$ ) fixed on one end to the SNA 560 turning lathe universal (between the 3 tanks) and leant on the other end to the peak of the sleeve.

In figure 11 we notice the turning tool made of fast steel before the experiment (without wear) respectively the turning tool after the experiment (worn). We notice the wear is approximately the same after each experiment (when cutting the semi-manufactured OLC60 respectively when cutting the semi-manufactured OL50 according to table 2).
Fig. 11 Turning tool (HSS)

a) without wear; b) wear after the first experiment; c) wear after the second experiment;

**EQUIPMENT:** SNA 560 X 1000

**TOOL:** Rp2, $\chi = 90^\circ$, $\chi' = 20^\circ$, $\gamma = 6^\circ$, $\alpha_o = 6^\circ$, $\lambda_s = -10^\circ$, $r_e = 0.4$ mm

**MATERIAL:** OLC60, OL50

**ENVIRONMENT:** air

**AMC:** caliper

<table>
<thead>
<tr>
<th>Table 2 Technological parameters for conducting the experiment</th>
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<td>Nr.</td>
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<tr>
<td>9</td>
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</tbody>
</table>

Knowing the diameter of the semi-manufactured product, the cutting depth and the advance of the tool, we set the section length $L_0$ such that the path followed by the peak of the tool on each section is 25 m long (formula 9, paragraph 4.2).

\[
L_0 = 25000 \cdot \frac{s}{\pi \cdot (D - 2 \cdot t)}
\]

\[
= 25000 \cdot \frac{0.1}{\pi \cdot (56 - 2 \cdot 1)} = 14.7[\text{mm}]
\]

The cutting speed of each section is determined by using the following formula:

\[
v = \frac{\pi \cdot D \cdot n}{1000} \left[ \frac{m}{\text{min}} \right]
\]

The processability indicator of this method is the compatible speed $v_{\text{comp}}$, which is determined using the relation (10) found in paragraph 4.2.

For OLC60 the wear of the tool appeared on section 8, when only 9 mm of the section were cut ($L_z = 9$) while for OL50 the same tool wear was found on section 9, when only 7 mm of the section were cut (according to table 2). Therefore, the speed compatible with the two materials will be:

\[
v_{\text{comp}} = v_{z-1} + (v_z - v_{z-1}) \cdot L_z / L_0
\]

\[
v_{\text{comp \ OLC60}} = v_7 + (v_8 - v_7) \cdot \frac{L_8}{L_0} = 110.83 + (140.74 - 110.83) \cdot \frac{9}{14.7} = 129.14 \left[ \frac{m}{\text{min}} \right]
\]

\[
v_{\text{comp \ OL50}} = v_8 + (v_9 - v_8) \cdot \frac{L_9}{L_0} = 140.74 + (175.92 - 140.74) \cdot \frac{7}{14.7} = 157.49 \left[ \frac{m}{\text{min}} \right]
\]
The value of the compatible speed $v_{\text{comp}}$ is used as an assessment criteria for processability, a higher value meaning a better processsability. Therefore, following the experiment, we can state that OLS0 is more processable than OLC60, using the fast steel tool whose geometry ($\gamma_e = 90^\circ$, $\chi_e = 20^\circ$, $\gamma_a = 6^\circ$, $\alpha_a = 6^\circ$, $\lambda_s = -10^\circ$, $r_e = 0.4$ mm) was written in table 2.

The process has limited applications and it is hard to apply it to carbide tools or mineral-ceramic materials.

The attmpts for durability measurement that are based on the cutting path, for which rapidly increasing speeds were used have the advantage of a hoerter interval of time, but they produce a wider distribution of results.

## 6 CONTRIBUTIONS AND CONCLUSIONS

The paper states in a clear and brief manner the way in which tool wear leads to the apparition of wear characteristics (implicity for the famous Taylor formula). Based on them we can determine the processability indicators.

Moreover, the paper presents the experimental results of two factory methods (short and fast methods, with a minimal consumption of cutting tools): the frontal turning method respectively the longitudinal turning method by gradually increasing speed.

The experiments were conducted on the equipment from the Machine Building Faculty’s BAGS laboratories.

Calculations and results interpretation lead to the following conclusion: a certain material is more processable with that tool that provides a higher value for the processability indicator (a bigger value for $v_{15}$ or $v_{\text{comp}}$).

For the frontal turning method, by comparing the values of the processability indicator ($v_{15}$) for the two materials, we can draw the conclusion that ODL60 is more processable using the carbide metal tool (having the geometry written in paragraph 5) than the OLC45 semi-manufactured product.

For the longitudinal turning method by gradually increasing speed, following the experiment, we can state that OLS50 is more processable than OLC60, by using the fast steel tool whose geometry was written in table 2.

The results of this paper provide new research opportunities that must be studied in the future. Among these we have:

- establishing new experimental methods and analytical models for determining the processability of materials, based on the evolution of wear curves (or durability) according to the cutting speed – for example in case of cutting a conical semi-manufactured product,
- establishing the influence of the energy consumption level and level of the cutting forces over the processability of materials.

## 7 REFERENCES