Influence of TiN coating on criterion of wearing drills in a line of frame casting

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Summary
The text shows the influence of TiN coating on wear and tear of drills which are made of low-alloyed high-speed steal SW2M5 while holes drilling in spheroid cast iron samples GG50. The results showed that only wear and tear of the VBwo tops is monotonically rising in a time and can be assumed as criterion of wear and tear. The value of VBwo that starts the wear and tear depends on the parameters of machine cutting and features of material processing.

Key words: parameters of machine cutting, production line, drill, TiN coating, criterion of wear and tear.

1. Introduction
While planning a system of production the most important is continuous flow, sucking system and delivery of raw material to the production lines [1]. While designing the line of frame casting fig. 1 are also machine needed to machine working. The machine working consists of the following operations: cut off sprue, front processing, drilling, countersinking, reaming, threading and milling. The sum of machining time is about 30% of the time of frame making [2].

Fig. 1. Designing the line of frame casting [1]
In operation of mechanical working the important problem is the identification of the tool that limits the size of a production stroke and providing the proper time of consistency through selection of the proper blade material and using proper surface treatment. To achieve this aim the proper algorithm has been prepared, which is describe in this text [3,4,5], and which is giving an opportunity to:

- select proper machine cutting parameters
- select the proper structure and the material of the part of tool machine cutting
- propose the most proper surfacing.

Spread coating on cutting tools, which are made for plastic forming, and parts of machines make very important field in surface engineering. The surface engineering is developed rapidly, what is seen in permanently growing range of using spread coating with PVD methods. Mainstream of developing PVD coats relied on changing in: chemical constitution, structure, and configuration of nitride layers in coats, starting from two-component nitride TiN till multicomponent (e.g. TiAlCrYN) and multilayer nitride systems [6].

While frame processing the drilling operation, reaming, countersinking, threading take over 50% of the time needed for frame mechanical working and therefore the special attention is paid to drilling operation [7,8].

At the beginning the criterion of wear and tear for major arc of drill was established, and it shows:
- specifically changes in its geometry,
- increases monotonically within the scope of normal using.
- establishes wear and tear criterion of VB.

In thesis [9], which concerns established of wear and tears of drills made from NSS SW2M5 showed that while drilling holes in a spheroid cast iron test pieces GG50 their wear and tears took place in tool flank. The analysis of dynamics of wear and tears places showed that in the whole range of testing machining parameters only the wear and tear tops have risen monotonically in a time and can be quite accurate measured. Because of the fact that just this wear and tear satisfies the criterion of wear and tear, and the size of VBw0’s, by which lost of drills cutting takes place, is the wear and tear criterion. The aim of this thesis was to establish the influence of TiN coat on assumed criterion.

2. Methodology of research

To establish the influence of spread TiN coating on assumed criterion of drill wear and tear at its constant using on, during the one time period of machining parameters durability, the set of research was done concerned the drills durability Ǿ10 made of steel SW2M5on which TiN coats with thickness 0,008mm was spread. According to the methodology [10] described in the text[9,10] and by the spheroidal iron GG50, HB=200 strength. The researches were done with Vc=24mm/min, f=0,3mm/revolution, Vc=40m/min f=0,1mm/revolution and ensured the period of time of drill durability T=25mit, what replies the finishing treatment 100-150 holes. The points where the measurement of drill blade was made is showed below (fig. 2).

![Fig. 2. The points of wear and tear of drill under control](image)

3. Results and analysis

The points of wear and tear of drill with TiN coating are under control by using spheroidal iron GG50, HB=200 with Vc=40m/min and f=0,1 mm/revolution are presented in fig. 3.

As you can see in the picture, while using the drills on machine cutting parameters the enormous using is visible on all controllers points of using. The period of time of normal using starts with VBwo=3mm, VBw=0,2mm, VB=0,15mm, VB=0,1mm. At the period of time of normal using, the size of using VB is also increasing.

As can you see in the fig. 3 while using the drills with spread TiN coating on machine cutting parameters, enormous using and loosing of machining properties follow after results of enormous using of all those places where using was controlled. Fig. 4 shows dynamics of using drills spread with TiN coat with Vc=24m/min, f=0,3mm/revolutions, which is described in a text [11]. According to researches the enormous using of flank surface of tops VB does not cause loss of machine ability of drills. It causes only intensity using of drills VBwo in a second stadium of normal using. Loss of machining properties is a result of enormous tops using which is started with VBwo=1,4mm.
As you can see both in the pictures 3 and 4 and from research results, while drilling holes in spheroidal iron GG50 using drills spread by TiN coat the results is the same while drilling holes with drills without spread [9]. However, intensity of wear and tear for controlled drills parts with TiN coat is smaller, which cause two times increase in durability of blade. This increase of durability is higher at high speed cutting and low rate of feed.

Spread of TiN coat doesn’t change those places where enormous wear and tear of drill is made, but causes decrease in intensity of wear and tear in place, which are under control.

The size of wear and tear of under controlled places determine the beginning and the end of the area of normal wear and tear. Both, the beginning of catastrophic wear and tear, and the beginning of the second part of normal wear and tear with using drills with and without TiN coat(pic. 4) are almost the same.
4. Summary

1. While drilling holes in a spheroid cast iron test pieces GGG50 with drills which are made of steel SW2M5 spread by TiN coat, their wear and tear takes place only on flank face.
2. While using drills with different parameters of machine cutting, loss of machining properties starts with different value of checking places using.
3. While drilling with high speeds of machine cutting and low rate of feeds, loss of machining properties starts with enormous using all of checking places (fig. 3).
4. While increasing rate of feed and decreasing speed of machine (fig.4) cutting starts very fast using of VB tops pressing surface and it does not cause loss of machining properties, but only increase intensity of VBwo tops using.
5. Spread of TiN coating causes, that for the drill with TiN coating the intensity of places which are under control is smaller, that cause almost two times increase in durability of blade, at the same time this increase of durability is higher with increase in speed and decrease in rate of feed

5. Bibliography