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A comparative analysis of machining of parts from 38H2MYuA by cutting tool of different materials

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Abstract. The variant of mechanical treatment of gear parts made of steel 38H2MYuA is described. Tool life of different materials - from R6M5K5 and ASP2052 is analyzed. It was found that for treatment of gear-wheels of steel 38H2MYUA by method of skiving, the most preferred variant is the use of tool made of powder steel than of high-speed steel.

The efficient choice of the cutting tool which possesses high physical and mechanical and operational characteristics, at blade processing of various hardware, is an actual task for any machine-building production, and especially at use of the modern equipment. The development of metalworking production is associated with both the creation of new and improvement of existing machine tools, and also cutting and auxiliary tools.

The cutting tool is a special object of metalworking technology. A variety of operating conditions and, consequently, the using of its cutting part cause various types of damage and failures of the technological system, and the tool wear rate is much higher than the wear rate of parts and components of the machine. Therefore, the performance of the technological system as a whole depends primarily on the quality of the cutting tool used [1-3].

Currently, in the engineering industry, tools from high-speed steel as well as from powder steel with various types of wear-resistant coatings are widely used. [2-6]

The article discusses the option of processing blanks parts made of steel 38H2 MYuA with internal gear. In the study the tool (see figure), made of steel R6M5K5 and powder alloy ASP2052, was used.



Figure 1. The detail and the tool for research.



To assess the tool life, a Power Skiving method was chosen.

The skiving technology is a high-performance processing of details like “disk” and gears with the processing of internal gears, and it is an alternative to pulling and notching. This method is characterized by high efficiency and very high cutting speed.

When machining gears wheels using the method Power Skiving, the issue of tool life is paramount. Therefore, when processing the details, two types of material for the tool were investigated:

1. High-speed steel R6M5K5;
2. Powder steel ASP2052.

Before operation, the tools were covered with wear-resistant coatings. As a base coating nitride aluminotitan coating (AlTiN) was used.

On a small amount of the instrument coatings of aluminotitanium carbonitride (AlTiCN) and aluminotitanium-chromium nitride (AlTiCrN) were also used.

Table 1. Coating characteristics of aluminum-titanium nitride (AlTiN)

Microhardness HV0,06	3500±500
Friction coefficient for steel	0,7
Coating thickness, micron	2-4
Thermal threshold	900°C
Coating color	light gray anthracite
Key features	perfect oxidation resistance and high temperature resistance

Processing of blanks was carried out on a CNC machine for cutting teeth by the method of skiving Gleason 300 PS. The number of tools in the test was 10 pieces from each material. The hardness of the blanks was 241-287 HB.

The results of the study and tool life are shown in table 2. For the indicator of tool life the number of machined parts to the reference value of wear (20-30 microns) was taken or to the occurrence of a chip on the working surface of the tool.

Table 2. Tool life with different coating

Tool number	Tool material	Coating	Wear resistance of the part	Note
1	ASP2052	AlTiN	80	
2	ASP2052	AlTiN	80	
3	ASP2052	AlTiN	80	
4	ASP2052	AlTiN	80	
5	ASP2052	AlTiN	80	
6	ASP2052	AlTiN	80	
7	ASP2052	AlTiN	80	
8	ASP2052	AlTiN	76	Chip
9	ASP2052	AlTiN	100	
10	ASP2052	AlTiN	100	
1	P6M5K5	AlTiN	50	
2	P6M5K5	AlTiN	50	
3	P6M5K5	AlTiN	46	Chip
4	P6M5K5	AlTiN	44	Chip
5	P6M5K5	AlTiN	36	
6	P6M5K5	AlTiN	44	Chip

7	P6M5K5	AlTiN	49	Chip
8	P6M5K5	AlTiN	44	Chip
9	P6M5K5	AlTiN	56	Chip
10	P6M5K5	AlTiN	32	Chip
1X	ASP2052	AlTiCrN	73	
2X	ASP2052	AlTiCrN	71	Chip
1C	P6M5K5	AlTiCN	37	Chip

The results of the study showed that the average tool life of high-speed steel P6M5K5 is ≈ 45 parts, and of powder steel ASP2052 - ≈ 83 parts. In addition, it should be noted that when using a tool from R6M5K5, a chip from 0.4 to 1.2 mm was observed on it.

Thus, based on the results of the study, it can be noted that for machining gears of parts made of steel 38Kh2 MYuA using the Skiving method, it is most preferable to use a tool from powder steel rather than high-speed steel.

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