https://gospodarkainnowacje.pl GOSPODARKA I INNOWACJE

LABORATORIUM WIEDZY Artur Borcuch

Volume: 35 | 2023

Economy and Innovation

ISSN: 2545-0573

For more information contact : editor@gospodarkainnowacje.pl

USING CHEMICAL-THERMAL PROCESSING METHODS, INCREASING THE LIFETIME OF THE CUTTING TOOL

Rakhmonov Tukhtasin Nurmamatovich
Andijan Machine-Building Institute
Rakhmonov.60@mail.ru 998916094263

A R T I C L E I N F O.

Key words: *composite, hard alloy, thermal processing, heat-resistant, plate, graphite, cutting tool.*

Annotation

The article examines the problems of manufacturing new and improved cutting tools with high performance, wear-resistant and heat-resistant construction. Composite material boron cubic nitride - a technology for the production of chemically and thermally treated plates from superhard materials.

http://www.gospodarkainnowacje.pl/ © 2023 LWAB.

Introduction. The main problem in today's modern machine-building enterprises is to ensure the quality indicators and the accuracy of the geometric shape of the manufactured product. Pre-determined methods of accuracy of details processed on metal cutting machines ensure that the accuracy and dimensions of the machine, device, cutting tool and detail do not change. Simultaneously with the development of the production of machine tools, work on the improvement of cutting tools is also developing. A cutting tool performs the processing of the surface of the detail and the creation of geometric shapes. Therefore, the development of the technology for the production of cutting tools with high performance, corrosion-resistant and heat-resistant construction is an urgent issue of today [1, p. 3].

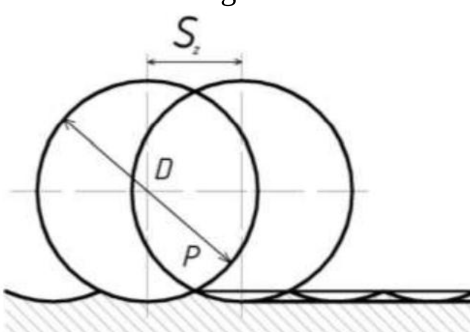
Research material and methods. In order to achieve high productivity, at the time when the need for new and improved cutting tool material used in production is increasing, one of the promising directions of cutting processing used in the tool industry is the production of ultra-hard materials based on nitride-composites. Cubic boron nitride is composed of 43.6% boron and 56.4% nitrogen and has a hexagonal crystal lattice like graphite. As a result of the application of high pressure and temperature during the processing of the material, the hexagonal lattice is transformed into a cubic lattice during the synthesis of boron and nitrogen. Cubic boron nitride (CBN) is a very hard, heat and chemical resistant material. In terms of hardness, BKN is 90 GPa, close to diamond, and in terms of heat resistance, it does not lose its properties at a temperature of 1800C. BKN's polycrystal and composite materials created on its basis for the production of cutting tools are branded under the name elbor-R and are produced in the form of cylinders with a diameter of 4...8 mm and a height of 3...6 mm [2, p. 27 .].

Copyright © 2023 All rights reserved International Journal for Gospodarka i Innowacje This work licensed under a Creative Commons Attribution 4.0

Research result. In carrying out scientific research work, in processing this composite material into difficult-to-work extremely hard, hardened parts, not only its hardness and heat resistance are important, but also in order to ensure resistance and strength to impact forces, elbor-R chemical-thermal by heating silicon and chromium nitride at high temperature, it was prepared in the form of a small plate under strong pressure in a graphite press. The main parameters of the improvement of the new cutting tool, cast with a hardness of gray cast iron equal to 200HB during the experimental work: Qualities that provide construction indicators; Qualities that provide technological indicators; Increasing productivity; Increase surface accuracy and quality; Use of materials that are close to improvement; Increase the accuracy of executive dimensions; Adjustment of geometric indicators; Application of new combined processing methods; Extend the length of the active cutting blade; Improving the process of forming surfaces; Increase uniformity and vibration resistance; Cutting tool in relation to Zagotovka; Using exchangeable plates, reducing the error of basing; Milling of the surface was carried out with the Elbor-R (silicon-chromium-nitride plate) cylindrical milling cutter with a speed value of Sz = 0.20 mm. It is known that a unique feature of milling is that the cutting teeth are in continuous movement with the processed surface. It is characterized by the fact that the cutting layer is not sheared uniformly. As a result, forced vibrations are formed during the cutting process, the teeth are rapidly bent, and unevenness with a step equal to Sz thrust is formed on the working surface (Fig. 1). In milling, the height of the surface unevenness from each other was determined according to the position of the point P where the two circles intersect, located at a distance equal to the thrust Sz relative to the milling tooth [3, p. 57. 4, p. 11104].

Surface roughness $R_z = \frac{D}{2} - \sqrt{\frac{D^2}{4} - \frac{S_z^2}{4}}$ the expression becomes simpler because 2 unevenness index compared to we generate .

$\frac{S_z^2}{4} = R_L D - R_L^2$ va $R_z^2 \le R_L D,\ R_L^2$



$R_z \approx \frac{S_L^2}{4D}$

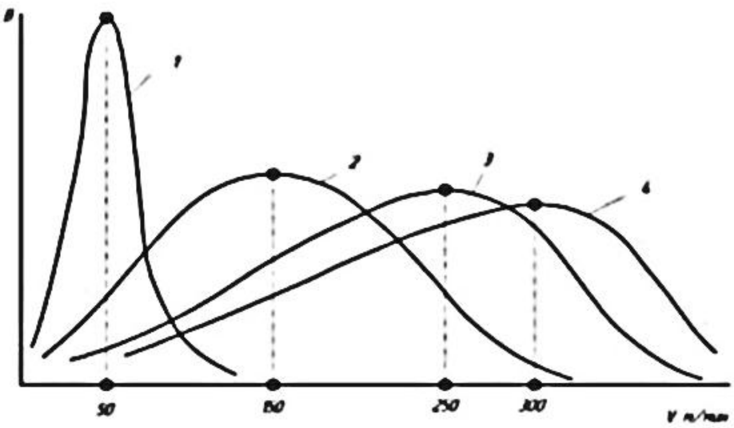
1 – picture. Appearance of unevenness with equal steps on the surface processed during milling.

Plastic displacement of the peak of micro-notex from the primary deformation area of the material; the greater the degree of deformation of the cut layer, the greater the speed of plastic displacement in the direction of the processed trace in the microprofile, and the height of the notches also increases. During milling, energy is spent, which is proportional to the thickness of the cut layer and the friction force between the surface of the cutting blade. 95% of the consumed energy is converted into heat, which is distributed to the cutting edge, the part of the saw blade near the cutting zone, the tooth blade and partially to the environment. The highest temperature is observed on the surface of the cutting blade. During the cutting process, the cutting edge of each tooth heats up to a temperature of 400°C to 750°C [5, p. 80, p. 6, 38].

Copyright © 2023 All rights reserved International Journal for Gospodarka i Innowacje This work licensed under a Creative Commons Attribution 4.0

When the milling cutter rotates on its axis, the next tooth blade partially cools until it touches a new surface, the heat is absorbed into the body of the tool, and the rest is dispersed into the environment. When working with cast iron and other brittle materials, the resulting swarf is slightly rubbed against the front surface of the tooth, the heating of the tooth blades is insignificant, and the use of coolant is not required. This is because when the coolant is applied, the hard alloy plates heated to a high temperature during cutting are exposed to the coolant flow. As a result, due to the sharp cooling of the surface layers of the plate, large internal cracks appear in it. This continuous stress often leads to the cracking of the plates and the fragmentation of the teeth [6, p. 238, p. 7, 142].

Analysis of the research result. The results of the conducted research showed that when studying the physical-mechanical properties of a milling tool equipped with a plate made of elbor-R composite hard alloy material during its operation, when processing cast iron and heat-treated steel details, the correct shearing modes found confirmation that the selection of ri is important. The speed of cutting and the speed of pushing the tooth create conditions for long-term maintenance of heat resistance, bending resistance and strength of the cutting blade [8, p. 29]. Elbor nitride composites showed high creep rates when compared with other alloys with respect to the highest cutting speed θ



(Fig. 2).

Figure 2. Comparison graph showing the bending resistance of hard alloys at different cutting speeds: 1 - hard alloy T15K6; 2 – hard alloy T30K4; 3 – hard alloy T60K6; 4 - elbor - R.

Conclusion. Cutting tools equipped with boron nitride composite materials retain their properties even at a cutting speed of up to 1000 m/min. When creating new types of cutting tool materials, two important properties that determine the cutting ability of tools are always taken into account - heat resistance and creep resistance. When a milling tool equipped with a boron nitride composite plate worked at high cutting speed, it was observed that the temperature at the cutting edge of the plate increased from 400oC to 750oC. The use of lubricating-cooling fluid during the cutting process causes cracks to form on the surface of the plate. Therefore, it is not recommended to use coolant.

References.

1. Usmonov K.B. Metallarni kesish asoslari: Oliy o'quv yurtlari uchun. – T.: ―O'qituvchi‖, 2004. – 160 b.
2. Kishurov B.M. Naznachenie ratsional'nix rejimov rezaniya pri mexanicheskoy obrabotke: Uchebnoe posobie. – Izd. 2-e – ―Lan‖, 2018. – 216 c.
3. Gaponkin B.A. i dr. Obrabotka rezaniem, metallorejushiy instrument i stanki: Uchebnik dlya srednix spetsial'nix uchebnix zavedeniy po mashinostroitel'nim spetsialnostyam. – M.:

Copyright © 2023 All rights reserved International Journal for Gospodarka i Innowacje This work licensed under a Creative Commons Attribution 4.0

Mashinistroenie, 1990. – 448 c.

4. Granovskiy G.I. Rezanie metallov: Uchebnik dlya mashinostr. i priborostr. spets. vuzov. – M.: Vissh. visshk., 1985. – 304 c. , il.
5. Asatillayev Y.M. Effektivnaya texnologiya povishenie stoykosti rejushego instrumenta pri ispolzovanii smazochno-oxlajdayushiy jidkosti/Y.M. Asatillayev, G.G.Shermatov, M.U.Davronova, SH.B.Bekmirzayev, U.Y.Xaydarov// Nauchno-texnicheskiy jurnal FerPI. -2020. Tom- 24.- №3.
6. Asatillayev Y.M. Optimizatsiya parametrov rezaniya v zavisimosti ot glubini rezaniya i podachi/ Y.M. Asatillayev, G.G. Shermatov, S.A. Muxtorov // Nauchno-texnicheskiy jurnal FerPI.- 2020. Tom- 24.Spets vipusk - №3. S.-29-32.
7. Asatillayev Y.M. Methods for Optimizing the Dynamic Characteristics of the Main Elements of Machine tools during Cutting/ Y.M. Asatillaev // Design Engineering ISSN: 0011-9342 | Year 2021.-Issue:

1. 8 Pages: 11104 – 11111. 8. Asatillaev Y.M. Analysis of Plastic Deformation of the Cut Layer/ Y.M. Asatillayev // International Journal of Innovative Analyses and Emerging Technology.-2021. -Volume: 1 Issue: 5. – Pages: 57-59.

Copyright © 2023 All rights reserved International Journal for Gospodarka i Innowacje This work licensed under a Creative Commons Attribution 4.0