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Application of diamond abrasive tools in the processing of technical ceramics in parts of mining machines

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Abstract
Technological development of mining equipment is largely initiated by the improvement of technologies and tools for its production, including in the field of surface treatment quality, which, in turn, determines the reliability and productivity of machines. The use of technical ceramics in designing parts and assemblies of mining machines allows for significantly improved technical and production characteristics since the quality of the parts' surface treatment is traditionally carried out with diamond-containing tools. The diamond tools with ceramic bonds have the highest grinding performance at the abrasive shaping of ceramics. The tribotechnical characteristics of tools made of a material with a ceramic structure hardened with microdipersed diamond grains are investigated in this work. On the basis of the classical approach to the deformation of rough surfaces, a model has been constructed that makes it possible to estimate the influence of the structural components of a diamond mineraloceramic tool on the wear of technical ceramics. The relations for calculation of grinding productivity, diamond content in the worn layer of the abrasive tool and the value of specific diamond consumption have been obtained. Experimental studies confirmed the theoretical conclusions. It has been established that the greatest influence on grinding productivity is exerted by diamond granularity, loading and speed modes; diamond concentration significantly determines the relative wear resistance of the abrasive tool. The obtained relations will be useful in the design of diamond-containing tools for processing technical ceramics, which is increasingly used in the design of mining machines since its market is growing dynamically around the world.

Keywords
mining equipment, abrasive diamond tool, processing of technical ceramics, contact interaction model, grinding performance, diamond tool wear.

Introduction

In the mining industry, the service life of machine parts traditionally made of metal can be extended by improving the maintenance of equipment operating in aggressive environments – excavation, loading and transportation, crushing, separating, etc. However, the ceramic product extends the service life of mining equipment, which can significantly reduce maintenance costs and downtime losses. For example, one hour of downtime of a mining enterprise can cause losses of up to 180 thousand dollars caused by equipment shutdown. Ceramic products here can solve the problem of damage to machine parts by pieces of rock (Pilkington, 2024) – a common cause of breakdowns. This is facilitated, first of all, by the adaptation of technical characteristics of mining machine parts to unfavourable operating conditions – aggressive chemical and mechanical environment, mining pressure, and high temperature. The lower coefficient of friction for components made or coated with ceramics is no less important. For example, the most wearable parts of mining machines, which determine the life of the entire unit, are sliding bearing supports.

At the same time, the existing limitations for technical ceramics application in the production of parts of mining machines – brittleness, higher than that of metals, as well as reduced crack resistance – leads to an increase in the size of parts and narrowing of temperature and load ranges of application. Therefore, today, it is extremely important to provide a wide scope of research on the manufacture and application of mining machine parts made from and with the use of technical ceramics. Particular attention should be paid to the production of tools for the mechanical engineering industry involved in mining equipment production.

The technologies used in mining machinery for utilizing technical ceramics to manufacture individual parts are quite diverse. Traditional ceramic products used to increase the resistance of metal parts to abrasion, heat and corrosion with low friction rate and high abrasion resistance are widespread (with a maximum microhardness of 650 Vickers school (HV)) (Saint-Gobain Performance Ceramics & Refractories, 2024).

For the production of ceramic machine parts and engineering equipment (coated metal), such technologies as thermal spraying are widely used (Gaur et al., 2024), as well as diamond grinding of products to obtain defect-free surfaces (Liu et al., 2023). The most promising field of manufacturing products from technical ceramics is the production of components resistant to high temperatures, aggressive media, and high shear resistance (Madhankumar et al., 2024).

The global ceramic coatings market size was valued at around USD 7.8 billion in 2020 and is expected to grow annually by 7% from 2025 to 2030 (Figure 1).

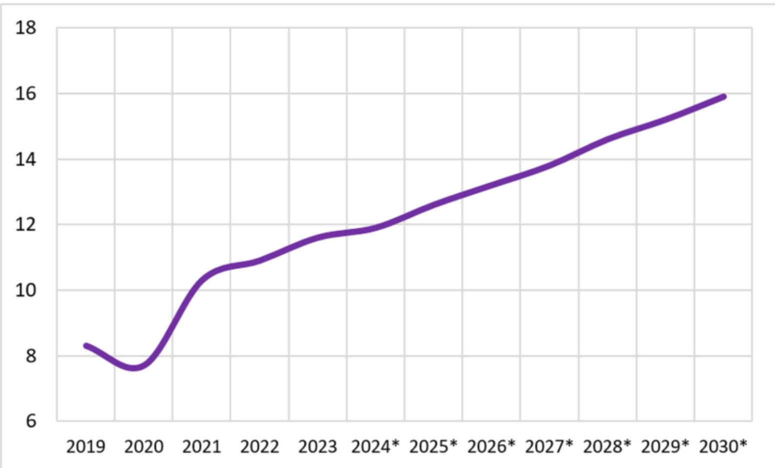

Fig. 1. Global Ceramic Coatings Market Dynamics, USD billion (from 2024 – forecast) (Statista, 2024).

The data in Figure 1 clearly show the promising expectations for the spread of technical ceramics in the industry, with a total growth of 80% by 2030 relative to 2019. At the same time, an important segment of the technical ceramics market is the mining industry, where the equipment operates under hard and stressful conditions, which causes high risks of enterprise shutdown and even bankruptcy (Shuvalova, 2024; Zhironkin et al., 2018), environmental pollution (Zhironkin et al., 2022; Isupova et al., 2022). In turn, the safety of mining machinery and equipment is directly determined by their reliability and continuity of operation under high loads and aggressive environment (Abu-Abed et al., 2016; Abu-Abed, 2018), which affects the management of the enterprise (Gerasimova, 2023; Barysheva et al., 2023). The determining factor here is the scientifically justified choice of effective and lean methods of machining parts from technical ceramics processing, which, in turn, should have high strength, crack and wear resistance. Ultimately, the use of modern methods of technical ceramics parts machining allows not only reducing the mass of products and the friction rate but also reducing the energy consumption and environmental damage, compared to the creation of metal products (Verzhansky et al., 2011; Stone et al., 1998).

A number of studies provide an overview of equipment parts used in the mining industry made of technical ceramics:

- individual parts of engines of dump trucks, loaders, and diesel trucks (turbocharger rotors, cylinder liners, valves, etc.) (Ciniviz et al., 2012; Noor et al., 2014);
- parts of pumps used for dewatering and hydro washing of quaternary sediments (gaskets, valves, mechanical seals, throats, flaps, etc.) (Zotov et al., 2024);
- parts of sliding bearings, drill bits, and scraper blades (Hsu et al., 2024).

A number of works have considered methods for predicting the serviceability of tools made of technical ceramics, such as replaceable polyhedral inserts made of "black" ceramics, applicable for fine machining of surfaces of equipment parts (Maksarov et al., 2017; Stone et al., 1998).

As a result of theoretical experimental studies, the dependences of wear intensity of mining machine parts on surface roughness, hardness, and maximum tensile stresses have been revealed. It has been established that the improvement of processing technology of technical ceramics products contributes to the increase of hardness and strength, fracture toughness, and reduction of roughness of working surfaces is promoted by such technological processes as synthesis of initial powders and grinding (together with final heat treatment).

In connection with the above, the study aimed to analyze the influence of structural components and operating parameters of diamond mineraloceramic tools on the machining of technical ceramics in mining machine parts.

Materials and methods

In general, the field of application of technical ceramics is not limited to mining engineering and the production of the required equipment. Traditionally, technical ceramics have been used as structural materials in mechanical engineering, instrumentation, automotive and aircraft, electrical and computer engineering, etc. (Zhang et al., 2023). Due to high hardness, wear resistance, and heat resistance, ceramics are successfully used in friction units and to manufacture abrasive, hard-alloy tools. However, these same unique properties determine the complexity of processing ceramic materials up to the stage of obtaining a finished product. Forming of materials of this type is possible only with harder ceramic or diamond-containing tools (Eminov et al., 2023).

The proposed technology for obtaining diamond-containing mineraloceramic material presented in this article allowed the creation of a tool that combines the cutting properties of diamond and ceramic products (Bolotov et al., 2020a; Bolotov et al., 2020b). The obtained material showed higher productivity (1.3-3.3 times) when machining technical ceramics compared to traditional diamond-containing tools with metal and organic bonds (Bolotov et al., 2020c). The composite is characterized by close mechanical properties of diamond and ceramic bonds, high diamond content, and the ability to resist deformation at high temperatures. The technology of obtaining a diamond-containing instrument involves varying the structural components: grain size, diamond concentration, metallization, etc. It is possible to increase the operating parameters of diamond ceramic tools by linking the physical and mechanical properties of its components with the properties of the ceramics being machined, as well as the load and speed conditions of cutting. In fact, it means to design the composition of diamond-containing mineraloceramic material to process specific technical ceramics.

When analyzing the fracture mechanics of the diamond-containing composite, the morphology of the working surface of the tool after wear was studied, which showed the absence of traces of abrasive wear and signs of "salting" of diamond cutting edges. It was found that the material works in the self-sharpening mode: worn diamond grains are broken out together with a part of the surrounding ceramic base, exposing a new cutting layer. According to the results of experiments, it can be assumed that the contact of diamond-containing mineraloceramic material with the processed ceramic surface has an elastic character and, with increasing load, is accompanied by subsequent brittle destruction of the tops of microroughness.

The theoretical modeling of the wear of ceramic materials has received researchers' attention (Grigoriev et al., 2023; Mahedi et al., 21024). The most common approaches are linear elastic fracture mechanics and Weibull statistics (Lei et al., 2020; Shin et al., 2019; Amaral et al., 2008). The nature of wear of diamond-containing materials with ceramic bonds is less well studied. The complexity of the problem lies in the emergent integration of physical and mechanical properties of the structural components of the composite material (Sivakumar et al., 2024; Bolotov et al., 2018; Fedorenko et al., 2017).

Authors who have experimentally investigated the abrasive wear of diamond-containing ceramic materials emphasize that they have brittle fracture without noticeable traces of plastic deformation, in contrast to diamond-containing materials with less hard base (Boland et al., 2010; Zheng et al., 2018). The work (Novikov, 2022) obtained data on the invariant linear-elastic character of wear of abrasive diamond-containing ceramic tools.

More studies are devoted to diamond-containing materials with traditional bases: organic and metallic (Sudnik et al., 2012). In these cases, it is recommended to use mathematical models of elastic, brittle, and elastic-plastic contact (determined by the load-velocity modes of machining) when building a model of contact interaction between abrasive tool and workpiece. However, even when using low-modulus bonds (compared to ceramics), the authors emphasize that elastic interaction is the most typical and preferable mechanism for the stable operation of abrasive tools. In addition, well-known mathematical models do not consider the physical and mechanical properties of all structural elements of composite materials, their dimensions and the microgeometric parameters of contacting surfaces. Wear models often rely on empirical coefficients and do not consider the specificity of abrasive wear of ceramics.

When calculating friction parameters, we use the basic wear equation (Holmberg, 2014). The model should consider the physical and mechanical properties of materials of diamond-containing mineraloceramics, especially ceramics, their microgeometry and loading conditions. Let us assume that the contact of microroughness on the friction surfaces of abrasive diamond-containing ceramic tools is linear-elastic in nature.

Then let us consider the contact interaction of an elastic rough half-space, which is a ceramic base with dispersed diamond grains distributed in it, moving along the rough surface of an elastic wearable ceramic control piece (Fig. 2). The surface of the composite material will be modeled by a set of spherical segments of the same radius R, the diamond grains are distributed in the material with a volume density τ. We will use the concept of an equivalent surface (Kovalev et al., 2019), the vertices of the microroughness of which are distributed according to the exponential law so that the distribution of the material in the surface layer of the model and the real surface is described by the same reference curve. To describe the contact characteristics of a single microroughness, we apply Hertz formulas (Nosewicz et al., 2017), considering the significant thickness of the ceramic diamond-containing layer formed on the surface of the metal base. Considering that in most real tribojoints, the contact density is small, the mutual influence of microroughness can be neglected (Sadeghi et al., 2023).

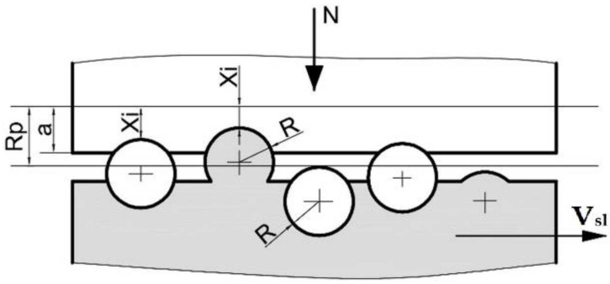

Fig. 2. Schematic of the contact between the rough composite half-space and the surface of the ceramic control piece.

where: N – applied load,
where: N – applied load,
Rp – surface roughness parameter: height of the largest profile protrusion within the base length;
a – convergence of rough half-spaces;
x_i– deviation of a single microroughness from the height of the largest profile protrusion;
R – microroughness radius;
V_{sl} – sliding speed.

The applied load in the contact zone N is represented by the sum of forces perceived by diamond grains, and surface microroughness is (1):

$$N = \tau \int_0^a N_{i\,dg}(a_i) \times n'(x)dx + (1-\tau)\int_0^a N_{i\,sr}(a_i) \times n'(x)dx, \tag{1}$$

where: $N_{i\,dg}(a_i)$ and $N_{i\,sr}(a_i)$ – forces acting on a single diamond grain and a single microroughness of the matrix material;
$n'(x)$ – x derivative of the protrusion distribution function.
Let us take the distribution function of protrusions as follows: $n(x) = \frac{tm\times\nu\times A_a}{2\pi R\times Rp^{\nu}}x^{\nu-1}$,
where: $n(x)$ – number of protrusions, the tops of which are located above the level of x, ν;
Rp, tm – roughness parameters of interacting surfaces (Chichinadze et al., 2003);
A_a – nominal contact area.

Using Hertz's relations for the calculation of elastic contact characteristics of unit spherical irregularities and taking into account that $a_i = a - x$ from the equation (1), we obtain the total load in the contact zone:

$$N = \frac{tm\times\nu(\nu-1)A_a\times a^{\nu+0.5}K_r}{1.5\pi\times Rp^{\nu}}\left(\frac{\tau}{I_a} + \frac{(1-\tau)}{I_c}\right). \tag{2}$$

where: K_r – roughness parameter of the interacting surfaces (Chichinadze et al., 2003);
$I_a = \frac{1-\mu_a^2}{E_a} + \frac{1-\mu_k^2}{E_k}$; $I_c = \frac{1-\mu_c^2}{E_k} + \frac{1-\mu_k^2}{E_k}$;

E_a, E_c, E_k – moduli of elasticity of diamond, matrix and control sample materials;
μ_a, μ_c, μ_k– Poisson's ratios of diamond, matrix and control sample materials.
From equation (2), we express the elastic convergence of a rough ceramic bond with dispersed diamond grains distributed in it and a rough ceramic control sample:

$$a = R_p \left[\frac{1.5\pi q_a}{tm \times \nu(\nu-1)\text{K}_r}\left(\frac{R}{Rp}\right)^{0,5}\right]^{\frac{1}{\nu+0.5}} (I_e)^{\frac{1}{\nu+0.5}}, \tag{3}$$

where: $q_a = \frac{N}{A_a}$ – nominal contact pressure;
$I_e = \left(\frac{I_a \times I_c}{\tau I_c + (1-\tau) I_a}\right)$ – equivalent elastic constant.
Let's assume that the abrasive shaping of interacting parts determines the total volume V of embedded irregularities:

$$V = V_1 + V_2, \tag{4}$$

where: V_1 and V_2 – deformed volume of the workpiece and abrasive tool. According to (Chichinadze et al., 2003):

$$V = \frac{A_r \times a}{\nu+1}, \tag{5}$$

where: A_r – actual contact area.
Using (3) and (5), the total volume V of embedded irregularities can be expressed as:

$$V = \frac{A_a \times tm \times R_p}{2(\nu+1)} \left[1.5 \frac{\pi q_a \times I_e}{tm \times \nu(\nu-1)\text{K}_r}\left(\frac{R}{R_p}\right)^{0.5}\right]^{\frac{\nu+1}{\nu+0.5}}. \tag{6}$$

Considering that A_r for both surfaces are the same, and the introduction of rough surface a_i is determined by the introduction of unit microroughness; we can write:

$$\frac{V_1}{V_2} = \frac{a_{i1}}{a_{i2}}.$$

By determining the introduction of unit microroughness from the materials of the part a_{i1} and sample a_{i2} according to Hertz's theory (Nosewicz et al., 2017), for deformed volumes, we obtain:

$$V_1 = V\frac{I_k}{I_e}; \qquad V_2 = V\frac{I_{ac}}{I_e}, \tag{7}$$

where: $I_k = \frac{1-\mu_k^2}{E_k}$; $I_{\text{ac}} = \frac{\tau(1-\mu_a^2)}{E_a} + \frac{(1-\tau)(1-\mu_c^2)}{E_c}$.

Proceeding from the fact that the depth of grinding by mineral-ceramic diamond-containing material of the ceramic surface is equal to the value of elastic embedding of the grain (Nosewicz et al., 2017) using formulas (6) and (7) we obtain the equation for calculating the grinding performance Q_t.

$$Q_t = \frac{S \times \upsilon \times tm \times R_p}{2(\nu+1)n} \left[\frac{1.5\pi q_a \times I_e}{tm \times \nu(\nu-1)\text{K}_r}\left(\frac{R}{R_p}\right)^{0.5}\right]^{\frac{\nu+1}{\nu+0.5}} \frac{I_k}{I_e}. \tag{8}$$

where: S – width of the wear zone;
υ – speed of mutual movement of the tool and the workpiece;
n – number of cycles leading to the separation of wear particles.
In the case of abrasive wear of ceramic material, n = 1 (Nosewicz et al., 2017).

The obtained equation corresponds to the experimental results obtained by (Drozdov, 2004) for grinding with diamond-containing composite ceramic materials. For diamonds with 100 µm grain size, the grinding performance is directly proportional to the speed of mutual movement of the tool and the workpiece, as well as to the contact pressure in the degree of 1.2 (for the characteristic value of ν = 2 for diamond-abrasive processing of ceramics, according to our data, the degree is also equal to 1.2).

Considering that for 100% concentration of diamond K diamond-containing material, take the content of diamond powder in the amount of 4.39 carats in 1 cm^3, the content of diamonds in the worn layer of the abrasive tool for grinding time *t* can be calculated by the formula (9):

$$m_a = \frac{8.78K\times S\times \upsilon\times t\times R_p\times tm}{2(\nu+1)n}\left[\frac{1.5\pi q_a\times I_e}{tm\times\nu(\nu-1)\text{К}_r}\left(\frac{R}{R_p}\right)^{0.5}\right]^{\frac{\nu+1}{\nu+0.5}}\left[\frac{I_{ac}}{I_e}\right]. \tag{9}$$

The wear of diamond-containing abrasive tools is characterized by the value of specific diamond consumption q_V, defined as the ratio of the mass of diamonds in the worn abrasive layer to the volume (mass) of the control sample material ground during the test. Taking into account (7) and (9) for q_V we obtain (10):

$$q_V = 8.78K\left[\frac{I_{ac}}{I_e}\right]. \tag{10}$$

The analysis of abrasive wear in the works (Chichinadze et al., 2003; Drozdov et al., 2004) for a wide class of hard materials and minerals also confirms the conclusion that the relative wear resistance is proportional only to the elastic modulus of the samples. In our model, the modulus of elasticity of the composite diamond-containing material also depends on the concentration of diamond grains.

Results

Friction tests were carried out on the standard friction machine MT-2 (Bolotov et al., 2020d). The friction scheme "finger–ring" was realized, and technical water was used as a lubricant. The performance of grinding with a diamond-containing composite of control sample made of electro-technical ceramics – ultrafarforum, and wear of the diamond tool was estimated directly. The relative error of the results did not exceed 12%.

The structure of the cutting surface and morphology of the machined surface of the control sample were analyzed using a metallographic microscope and standard profilometry methods GOST 19300-86 (GOST, 1998). The tested samples' appearance of mineraloceramic abrasive wheels is presented in Fig. 3. The structure of the working surface of diamond mineraloceramics with different grain sizes is shown in Fig. 4.

Fig. 3. Tested samples of mineraloceramic abrasive wheels.

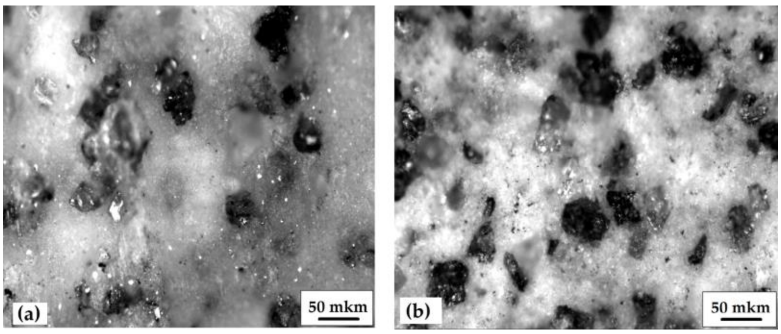

Fig. 4. Surface structure of diamond mineraloceramics (a) d = 63/50, K = 75 %, (b) d = 63/50, K = 100 %.

Fig. 4a shows the significant effect of the load in the tribocontact zone on the grinding performance for the selected material pair. According to formula (8), the grinding performance also grows with increasing pressure. With increasing diamond grain size, Q_t grows up theoretically (formula (8)), and it is confirmed by test results (Fig. 4a). The duration of stable workability of the diamond-containing composite is illustrated in Fig. 4b. It is established that the tool workability practically does not decrease during the whole testing period. Morphological analysis of the friction surface of the diamond abrasive tool has confirmed that it is not subject to salting: the worn grains are dislodged with a part of the tool, exposing the underlying diamonds in a timely manner. In this case, the "worn" grains are not removed from the friction zone but continue to wear the workpiece additionally. When using diamonds of higher grain size, grinding productivity is significantly higher, but the nature of the dependence does not change (Fig. 4b, formula (8)).

As a result of the tests, no significant effect of diamond grain concentration on grinding performance was recorded (Fig. 5 and 6). This is partly explained by the close mechanical properties of diamond grains and corundum base. As the number of contacting diamond grains increases, the load on each individual grain decreases, and the volume of ground material changes insignificantly. The fact that the strength properties of the processed ceramics in our experiment are lower than those of the diamond-containing abrasive also played a role. At close moduli of elasticity of diamond, ceramic bond and control sample materials, the influence of concentration on the elastic constants $I_э$ and I_{ac} is more significant.

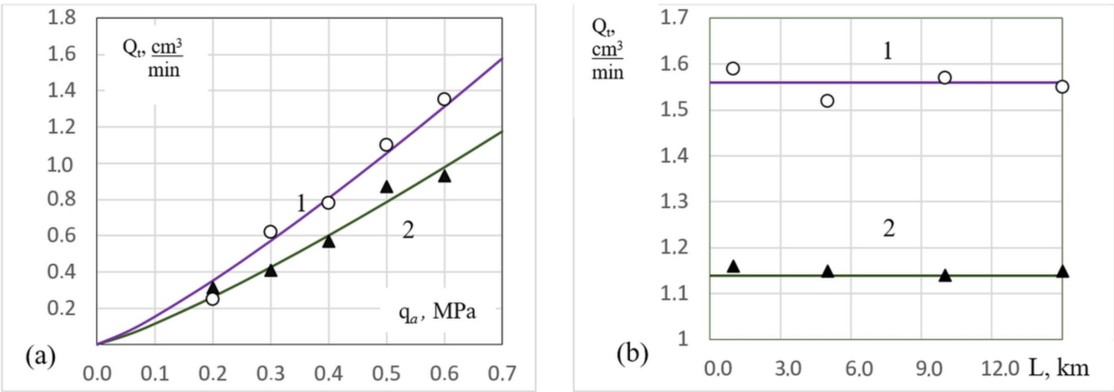

Fig. 5. Influence of pressure (a) and cutting path (b) on grinding performance (solid lines – calculation by formula (8), dots – experimental results: for line 1, d = 100/80; for line 2, d = 63/50.

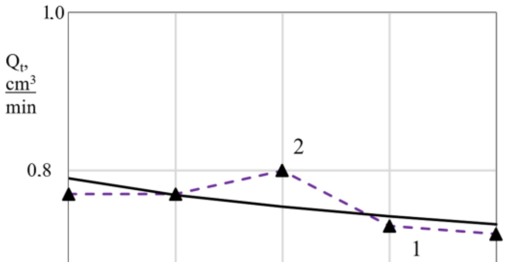

Fig. 6. Performance of grinding with abrasive tools with different diamond concentration: line 1 – calculation by formula (8); line 2 – experimental results q_a = 0.5 MPa, d = 63/50.

The wear of the diamond-containing ceramic tool was evaluated by the diamond content in the worn diamond-bearing layer (Fig. 5a) and the value of specific diamond consumption (Fig5 b). The figures show the results of calculations by formulas (9) and (10) in comparison with the experimental results. The mass of consumed diamonds grows with increasing load, grain size and grain concentration, with increasing "tool–part" contact area (formula (9)). The influence of the cutting path on the diamond content in the worn layer of the abrasive tool is shown in Fig. 7. The diamond concentration significantly determines the relative wear resistance (specific diamond consumption).

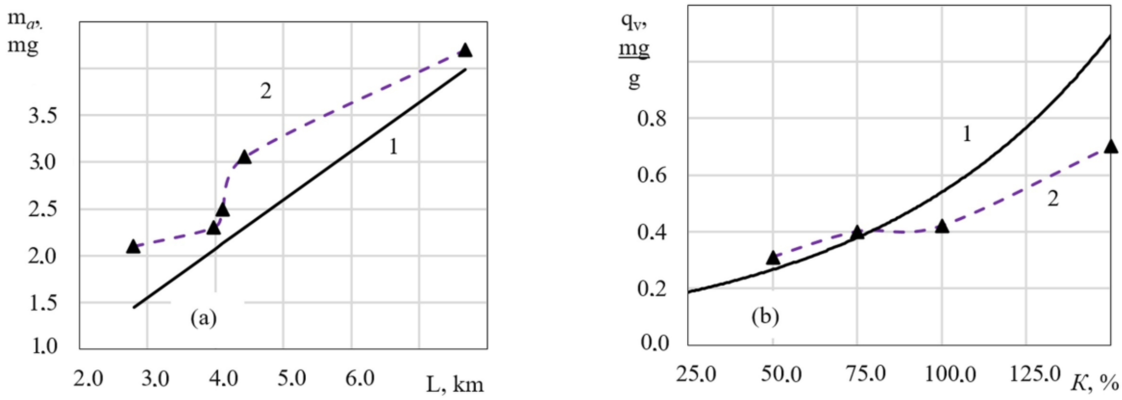

Fig. 7. Influence of cutting path on diamond content in the worn layer of abrasive tool (a) and diamond concentration on specific diamond consumption (b): line 1 – calculation by formulas (9) and (10); line 2 – experimental results q_a = 0.5 MPa, d = 63/50, K = 150 %

The data shown in Fig. 7 shows that the dependence is not directly proportional since the concentration of structural elements also determines the elastic constant of the composite material. Theoretical and experimental parameters of diamond mineraloceramic tool wear have similar change tendencies, but the error of these tests is somewhat higher.

Discussion

The paper analyzes the influence of structural components and operating parameters of diamond mineraloceramic tools on the grinding performance of technical ceramics in mining machine parts and the tool's wear. In contrast to the known phenomenological and statistical models, it allowed us to evaluate clearly, based on the classical theory of contact interaction, the influence of physical and mechanical properties of materials involved in the contact interaction, concentration and grain size of diamond, load-velocity properties of frictional contact on the parameters of diamond abrasive wear.

Analytical and experimental study of grinding performance by diamond abrasive tools in the processing of technical ceramics has revealed the following regularities:

1. Grinding performance is proportional to the pressure in the contact in the degree > 1 (in our calculation 1.2), which agrees with the results of studies by other authors; in the studied range of loads, the nature of the dependence did not change.

2. Grinding performance is directly proportional to the speed of mutual movement of the tool and the workpiece and does not depend on the duration of the grinding process.

3. With the increase of the granularity, the grinding productivity increases in the degree < 1 (in our calculation 0,6); the granularity does not affect the character of loading and rheological dependences Q_t.

4. The diamond concentration included in the operator $I_э$ significantly affects the parameters of abrasive wear in the case when the material of the processed ceramics has mechanical properties close to the material of ceramic bond and diamond. It was found that increasing the diamond concentration slightly reduces the grinding performance.

5. The study of the wear of diamond-containing abrasive tools was evaluated by calculating the mass of diamonds in the worn layer of the abrasive tool during the grinding time and calculating the value of specific diamond consumption.

6. When calculating the mass of diamonds in the worn layer of the abrasive tool, it was found that the patterns from the load in the contact, diamond concentration, granularity, speed and processing time are similar to those obtained for grinding performance. When designing an abrasive tool, it is necessary to take into account that the increase in diamond grain size and load growth of grinding productivity is accompanied by an increase in the mass of spent diamonds.

7. Optimization of load-rate modes selection and composition of diamond abrasive in wearing abrasive tool and workpiece can be carried out by the indicator of specific diamond consumption. This parameter is proportional to the diamond concentration and depends on the ratio of elastic properties of the contacting materials.

The results of the author's experiments have shown that this model is well suited for describing the characteristics of the frictional contact of a pair of materials "diamond-containing ceramics – ceramic". The obtained material has unique abrasive properties, realizing the self-sharpening mode during operation. The main achievement of this study can be considered the experimentally confirmed possibility of designing high-performance tools for diamond-abrasive machining of specific ceramics by selecting the grain size, diamond concentration, load and speed modes of tool operation. All of this allowed the advancement of the study of the technology of application of diamond abrasive tools in the processing of technical ceramics due to the author's experiment. The authors consider overcoming limitations, mainly decreasing the errors, to be the object of future research.

Conclusions

Due to its importance for the development of mining engineering – increasing the reliability of units and assemblies of mining machines – parts made of technical ceramics are increasingly being used and expanding their market. In this regard, the relevance of research in the quality of machining of mining machine parts, one of the leading methods of which is the surface processing of parts made of technical ceramics with diamond-containing tools, is increasing. As a result of the theoretical and experimental studies conducted, the connection between the characteristics of structural components of diamond-containing ceramic abrasive tools and the main parameters of wear during the shaping of a part made of technical ceramics has been established. The results of experimental studies confirmed the validity of the selected calculation method and the assumptions made.

It was found that with increasing sliding speed, applied load and diamond granularity, the wear of the ceramic part and diamond-containing abrasive increases: the grinding performance of ceramics increases, and the diamond content in the worn layer of the abrasive tool increases. The concentration of diamonds had no significant effect on these characteristics. The specific diamond consumption is proportional to the diamond concentration and depends on the modulus of elasticity of the contacting materials. The obtained dependences of wear parameters of technical ceramics and diamond mineraloceramic tools allow, at the stage of designing materials of this type, to optimize the granularity, diamond concentration, load and speed modes of tool operation in order to increase the parameters of their serviceability.

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