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ENHANCING WEAR RESISTANCE OF COMPLEX-PROFILE SECTIONS IN THE DIAMOND-ELECTROPLATED LAYER OF DRESSING TOOLS THROUGH THE INTEGRATION OF CVD AND HPHT DIAMONDS

Introduction. *At machine-building enterprises in Ukraine, imported guide rollers with SVD diamonds have been used for straightening modern abrasive wheels designed for grinding complex-shaped rotating surfaces. Chemical Vapor Deposition (CVD) represents a contemporary technique for laboratory production of diamond products through chemical vapor deposition, offering promising applications.*

Problem Statement. *During the grinding process with conventional diamond grinding tools, dispersed abrasive material actively erodes the bond in areas where synthetic monocrystalline diamonds are embedded. This results in the premature loss of diamonds before fully utilizing their resource. The elongated shape of SVD diamonds and their deeper embedment in the bond should enhance retention on the working surface, thereby increasing the lifespan of the dressing tool.*

Purpose. *This study aims to optimize the diamond-abrasive layer of the tool by electroplating a mixture of CVD and HPHT (High Pressure High Temperature) diamonds to improve the wear resistance of the tool's complex-profile sections.*

Materials and Methods. *Diamond powders derived from CVD and HPHT diamonds have been used. The elemental composition of impurities and inclusions in the powders has been analyzed using a BS-340 scanning electron microscope and a Link-860 energy-dispersive X-ray spectrum analyzer.*

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Results. *The experimental data have demonstrated that integrating CVD inserts into the high-load areas of the dressing tool significantly enhances the dimensional stability of the working profile. Additionally, the wear patterns of CVD diamonds, as well as HPHT crystals, under abrasive wheel dressing conditions with a ceramic bond, have exhibited characteristics of abrasive wear.*

Conclusions. *The incorporation of directionally improved complex-profile sections with a mixture of CVD and HPHT diamonds in the tool significantly enhances the efficiency and durability of diamond-electroplated dressing tools.*

Keywords: precision dressing tool, grinding powders of CVD- and HPHT-diamonds, diamond galvanic layer, diamond dressing tool, wear resistance of complex profile sections.

In various sectors of mechanical engineering, such as bearing, tool, and opto-mechanical manufacturing, the share of high-precision tools in total production has reached 50%. The cost of such precision tools, particularly diamond tools, has exceeded USD 1,000, making the issue of extending their operational life highly relevant. Notably, these tools are especially advantageous for production in Ukraine, as the cost of diamonds used in such tools reaches USD 200 per carat, compared to USD 0.5—1.0 per carat in standard grinding tools. Consequently, the development of technologies for creating new dressing tools with enhanced durability for truing abrasive wheels has become both important and timely.

Ukrainian mechanical engineering enterprises, particularly those in engine manufacturing, aggregate, and hydroaggregate plants, as well as aviation companies, require precision dressing tools. While such tools are available on the market, they are predominantly imported from companies such as CORUS (Switzerland), Schaudt and Reishauer (Germany), and Tyrolit (Austria). These tools are expensive and demand access to foreign currency resources. To meet domestic demand and even potentially enter the international market, the National Academy of Sciences of Ukraine, specifically the Bakul Institute for Superhard Materials, has been developing and producing effective dressing tools. These developments have been listed in the "Promising Scientific and Technological Developments of the NAS of Ukraine" reference publication since 2017. However, over time, the need for innovative improvements to these tools has arisen, which is the focus of this article.

CVD (Chemical Vapor Deposition) diamonds have already found certain applications in diamond tools, particularly dressing tools, as noted in previous reviews [1]. According to the GLOBAL CVD DIAMOND SALES MARKET REPORT, the global market for CVD diamonds is segmented into monocrystalline and polycrystalline categories. Projections indicate that by 2026, the global CVD diamond market will reach USD 568.9 million, compared to $364.8 million in 2020, with an average annual growth rate of 7.7% from 2021 to 2026. As a result, Ukrainian mechanical engineering enterprises have started adopting imported dressing rollers with CVD diamonds for truing modern abrasive wheels used in grinding rotationally symmetric, complex-shaped surfaces.

During the truing process using traditional diamond tools, dispersed abrasive material actively erodes the bond in areas where synthetic monocrystalline diamonds are embedded, causing them to fall out prematurely without fully utilizing their lifespan. The elongated shape of CVD elements and their deeper embedding in the bond are expected to stabilize their retention on the tool's working surface, thereby increasing the tool's durability. However, relying solely on CVD diamonds necessitates their dense placement along the tool's periphery for kinematic reasons. Otherwise, the abrasive material being trued will erode the bond at the points where CVD diamonds are embedded, leading to their premature detachment. Therefore, analyzing current developments to identify the specific features of forming an electroplated working layer, particularly with CVD diamonds, is essential for advancing the development of modern domestic dressing tools.

Precision diamond tools for mechanical engineering require modern approaches to the formation of their surface layer, combined with the application of new diamond materials, which significantly enhances their operational characteristics. Researchers have consistently paid attention to this aspect. In this article, we focus on the latest advancements in forming the diamond-abrasive layer of tools using electroplating, incorporating a mixture of CVD and HPHT diamonds, and the precision truing of complex-profile abrasive wheels.

Our previous studies have highlighted the features and applications of CVD and HPHT diamonds in diamond tools [1—3]. We have detailed the technological specifics of producing diamond tools with a working layer of CVD diamonds and the applications of such tools. Examples of polycrystalline CVD diamonds for dressing tools and their use in dressing rollers have been presented. These studies are of interest to us both in terms of the use of advanced diamond grains [2] and the diamond-electroplated coating [3]. Issues related to precision diamond dressing tools can be categorized into three main groups: firstly, diamond grains; secondly, the electroplated layer; and thirdly, aspects directly associated with the truing process. In this article, we also explore recent developments (2022—2023) reported in the scientific literature concerning these issues.

Initially, our attention has been directed toward developments related to various diamond grains and their properties.

In [4], CVD diamond films (ranging from nanocrystalline to polycrystalline) have been synthesized using the chemical vapor deposition method, where a hot graphite plate is employed to thermally activate methane and hydrogen. The applied pressure ranges from 40 to 100 GPa, the methane concentration in hydrogen varies from 0.5% to 2% by volume, and the substrate temperature is maintained between 1020° C and 1140° C. A maximum growth rate of 0.8 μm/h has been achieved, and the quality is comparable to diamond films synthesized by chemical vapor deposition on a hot metal filament. The resulting diamond films are free from metallic impurities [4].

In [5], the influence of carbon diffusion at an early stage on the microstructures of chromium carbides formed in a solid/solid (S/S) interfacial reaction between the (100) plane of a CVD diamond and deposited Cr has been investigated. It has been demonstrated that catalytically transformed disordered carbon (DC) is the first phase to form at the early stage of the S/S reaction. Anomalous carbon diffusion in the deposited Cr has been observed for the first time, revealing that such diffusion affects the interfacial microstructures. Specifically, carbon diffusion impacts the microstructure of the interface in the Cr layer. It has been found that the concentration of internal strain at the diamond-carbide interface significantly decreases when a coherent interface is formed between the diamond particle surface and chromium carbides. This finding is of fundamental importance for understanding diamond bonding mechanisms and allows for process parameter optimization to achieve composite materials with a metal matrix and desired properties.

Research [6] continues previously published research on the effects of hydrogen treatment on the structural properties of polycrystalline CVD diamond layers with varying grain sizes. Hydrogenated diamond layers subjected to a two-stage oxidation process have been analyzed: first by UV irradiation in air and subsequently by annealing at 300 °C in air. It has been established that microcrystalline and nanocrystalline diamond layers exhibit different behaviors during oxidation (Fig. 1). The efficiency of oxidation depends on the surface morphology of the diamond and the form of the amorphous carbon phase. In general, microcrystalline samples are more easily oxidized during UV treatment. Oxidation by ozone leads to the adsorption of oxidized carbon on the surface of hydrogenated nanocrystalline diamond [6].

Research [7] has analyzed the microtexture of CVD diamond coatings, which, apart from their function in retaining wear particles, can significantly reduce the friction coefficient through the graphitization of the diamond surface. The graphitization of a textured surface allows for a rapid decrease and stabilization of the friction coefficient at the initial stage of friction. After stabilization,

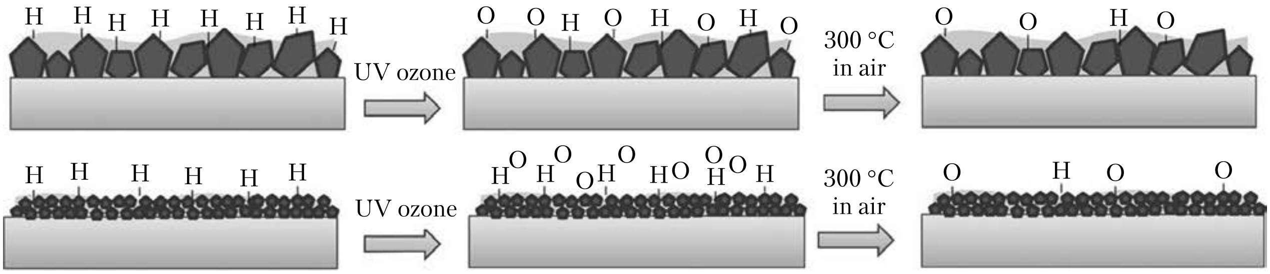
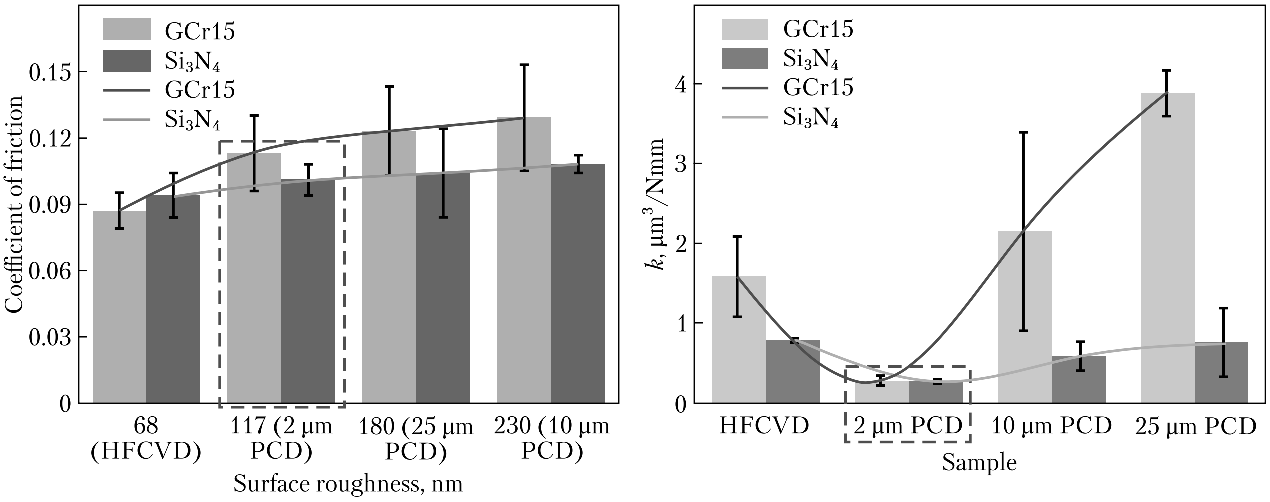


Fig. 1. Surface transformation of microcrystalline and nanocrystalline CVD diamond during UV-ozone-induced oxidation [6]



a *b*

Fig. 2. Variation of the coefficient of friction (COF) for PCD and HFCVD samples with increasing surface roughness (*a*), and change in wear rate (*k*) for ceramic Si_3N_4 and steel GCr15 balls with increasing grain size of PCD (*b*) [4]

the friction coefficient decreases further as the degree of graphitization increases. This finding is crucial for expanding the application scope of diamond coatings [7].

The tribological behavior of diamonds against various materials is fundamental to their use in abrasive and bearing industries. Study [8] describes the friction and wear analysis of two types of diamonds: HFCVD (Hot Filament Chemical Vapor Deposition) diamonds and PCD (Polycrystalline Diamonds) sintered under high-pressure high-temperature (HPHT) conditions, tested against GCr15 steel and Si_3N_4 ceramics.

A notable gap in the literature is the lack of discussion on the surface roughness of diamonds. During annealing, the initially smooth surface of polished PCD has undergone significant roughness changes due to excessive thermal expansion of cobalt and the detachment of small diamond particles. Additionally, cobalt leaching has further contributed to PCD surface roughness by increasing porosity.

The findings (Fig. 2) indicate that the friction coefficient (COF) has increased with the roughness of the diamond surface. Both the COF and wear rate (*k*) of Si_3N_4 ceramic balls are generally lower than those of GCr15 steel balls, except for the COF of the HFCVD sample. The wear rate (*k*) increases as the grain size of PCD grows, accompanied by a reduction in the residual cobalt content.

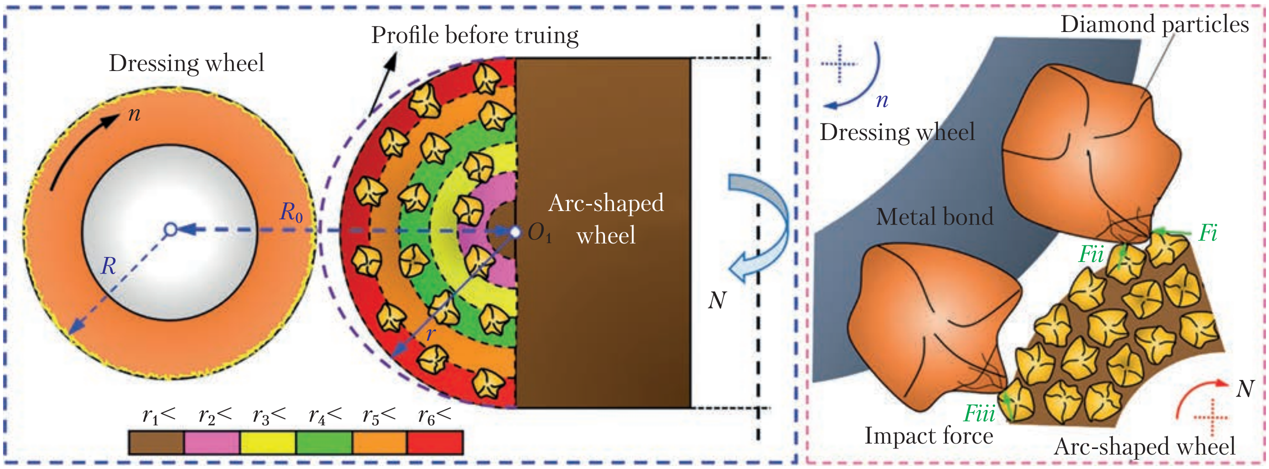


Fig. 3. Schematic diagram of arc-shaped diamond wheel dressing [9]

Figure 2 demonstrates that CVD diamond has exhibited the lowest friction coefficient. Regarding wear rate, CVD diamond has been surpassed only by polycrystalline diamond with a grain size of 2 μm in its structure.

Now, to conclude this brief review, let us examine the publications dedicated to issues directly related to truing technology.

Study [9] provides a detailed description of the study on the wear characteristics of diamond truing wheels with electroplated coatings, which are used for precision truing of arc-shaped diamond wheels. The study has investigated wear topography, diamond protrusion height, and the mechanism of wear of the metal matrix. It is important to note (Fig. 3) that the profile of arc-shaped diamond wheels before truing exhibits a wavy form (profile before truing) with increased radial runout. In other words, during the preliminary diamond processing, the diamond wheel has developed a wave-like wear, a phenomenon we have repeatedly identified as a regular wear process [10]. As observed in [9], this has been confirmed. It has been established that the precision of truing diamond arc-shaped grinding wheels can be significantly improved by reducing the wear of diamond particles on the electroplated truing tool. In a truing wheel with a coarse grain size of diamond particles, graphitization occurs, and the rate of diamond wear accelerates. For example, a truing wheel with a grain size of D213 microns has successfully reduced the radial runout error of an arc-shaped diamond wheel with a hybrid bond from 35 microns to 1.9 microns. This indicates that the wave height on the wheel surface during diamond processing has been 35 microns [9], which falls within the limits we have presented in [10].

In [11], a combined method of truing, involving laser rough truing and electrical discharge (ED) precision truing, is applied to achieve high-performance and precise truing of the aforementioned arc-shaped diamond grinding wheels (Fig. 4). The laser spot size and the energy emitted by the laser onto the grinding wheel surface change over time depending on the truing path, which complicates the implementation of high-precision truing. Therefore, the laser rough truing method is used for quickly removing the excess abrasive layer, while the electrical discharge precision truing has not only improved the accuracy of the arc-shaped contour but also restored the cutting ability of the grinding wheel. The arc-shaped profiles with a radius of 13 mm are produced on a diamond wheel with a diamond grain size of D120. The radius of the final processed profile is 13.007 μm, with a profile error of 10.67 μm. It has been established that the diamond grains on the surface of the wheel are, to some extent, graphitized. The degree of

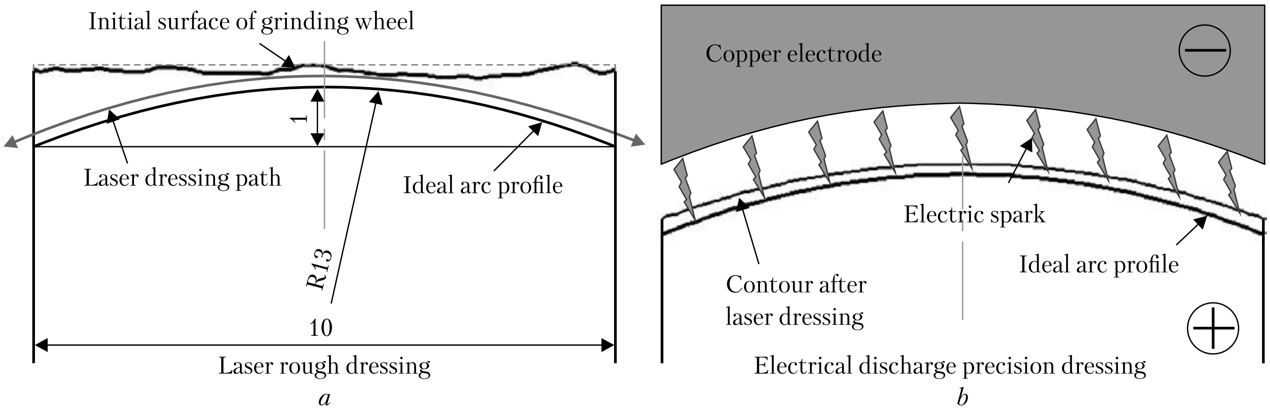


Fig. 4. Dressing of diamond grinding wheels: laser rough dressing (*a*) and electrodischarge precision dressing (*b*) [11]

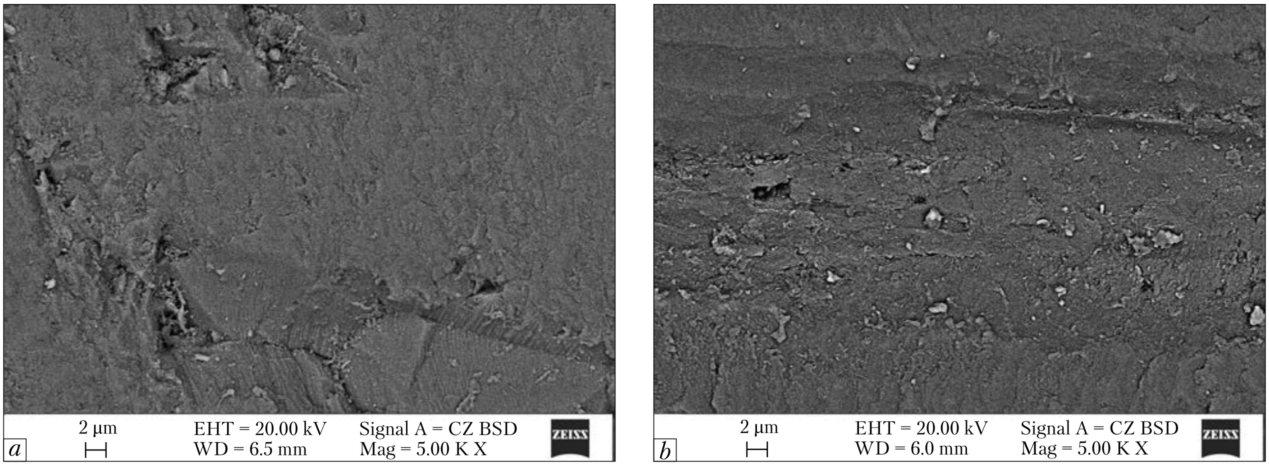


Fig. 5. General view of CVD diamond surfaces: original (*a*); polished (*b*)

damage to the diamond grains during laser truing is significantly higher than during electrical discharge truing. However, most of the graphite layer on the surface of the diamond particles can subsequently be removed during the grinding of alumina ceramics [11].

Considering the above, let us proceed directly to the presentation of our research related to the use of CVD diamonds in truing tools.

In this case, we are interested in polycrystalline CVD diamonds for strengthening the problematic areas of the diamond precision truing tool. Since the CVD diamond inserts with dimensions of 0.8 × 0.8 × 1.5 mm are obtained from a Chinese manufacturer, the surface of the inserts

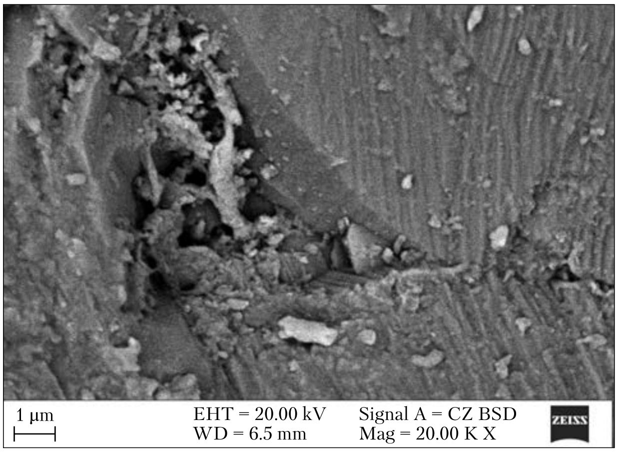


Fig. 6. General view of the boundaries of three CVD grains on the initial surface

Fig. 7. Working surface of the diamond truing roller in a plan view: the middle part with CVD-diamonds and the two outer sections with HPHT-diamonds (grains of powder AC200T 400/315 evenly distributed) are depressed, as the baseline

is analyzed using an electron microscope for more informed application. The samples are examined by scanning electron microscopy (SEM) at different magnifications on the ZEISS EVO 50XVP scanning electron microscope, equipped with an energy-dispersive X-ray spectroscopy (EDX) analyzer INCA450, featuring the INCAPentaFETx3 detector and the HKL CHANNEL-5 system for electron backscatter diffraction (EBSD) from OXFORD Instruments (scanning electron microscopy and microanalysis, CEMMA), with additional use of the Everhart-Thornley secondary electron detector and a highly sensitive 4-quadrant phase CZ BSD detector at different magnifications. Two surfaces of one sample have been analyzed: the original surface (Fig. 5, *a*) and the ground surface (Fig. 5, *b*).

Table 1. **Elemental Composition of the Studied Surfaces**

Surface	Elemental composition, % wt.		
	Carbon (C)	Oxygen (O)	Aluminum (Al)
Original (Fig. 5, *a*)	84.79	12.13	3.08
Polished (Fig. 5, *b*)	97.63	—	2.37

Based on the photographs of the CVD diamond surfaces (see Fig. 5) and the data from the table, the following conclusions can be made:

- On the original surface, a polycrystalline nature is observed, and it is even possible to see certain grain boundaries that make up the polycrystal itself. This is especially noticeable at higher magnifications (Fig. 6), where the boundaries of three CVD grains converge.
- The original surface of the CVD diamond shows an increased amount of oxygen, which is absent on the ground surface. In other words, the surface of the CVD diamond, due to its higher defect density (see Fig. 5), is also impregnated with oxygen. In the case of the ground surface, a smoothed surface is observed (see Fig. 5, *b*), with a complete absence of oxygen.
- It is also worth noting that polycrystalline CVD diamonds contain a small amount of aluminum (within 2—3% by weight).

The study investigates the dimensional stability of truing rollers made by electroplating using CVD diamonds for the abrasive shaping processes of complex-shaped surfaces of products. During the truing of abrasive wheels with traditional diamond tools, the dispersed abrasive material actively washes away the bond in the areas where synthetic monocrystalline diamonds are embedded, causing them to fall out before utilizing their full potential. The elongated shape of CVD inserts and the deeper embedding in the bond are expected to stabilize their retention on the working surface of the tool, especially in areas of the working profile with large curvature, thus increasing the service life of the truing tool. The use of CVD inserts in a truing tool, where the working layer is formed using electroplating, minimizes the need for further finishing of CVD inserts to the corresponding working profile of the tool.

Tests for the durability of rollers with CVD diamonds are conducted on a special stand based on the 3B151 cylindrical grinding machine, with an autonomous drive for the truing roller, and by truing abrasive wheels using a grinding scheme with axial feed. To replicate the working conditions of the diamond layer on the roller under plunge dressing, the axial feed S is set to be equal to the length L of the section protected with CVD inserts, as per [12]. The speed of the abrasive wheel (29 m/s) and the roller (14.6 m/s) matches the dressing parameters used in production conditions. Abrasive wheels of dimensions Ø600 × 63 × 305, with grades ranging from 25A F60 J 7V (25M3) to 25A F60 N 7V (25CT1), are dressed with an axial feed S = 1.0 mm/rev (U = 18.3 mm/s and a depth feed t_0 = 0.010 mm.

The testing is conducted according to the plan of a one-factor experiment, with the variables being the number of CVD inserts on the working surface of the truing tool and the characteristics of the abrasive wheel being dressed, including hardness, structure number, and grain size.

To intensify the experiments, the laboratory rollers are designed with two rows of CVD inserts along the circumference on the working surface, positioned at the edges of the straight profile (8 mm) of the tool, forming two corresponding apexes with rounding radii R_L and R_R (Fig. 7). In this case, each roller corresponds to two values of the number of CVD inserts. The profile contains a depressed (by 1 μm) part that serves as the base and does not contact the abrasive wheel during the main operation, and therefore, is not subject to wear. The linear wear (depression of the apex δ) of the areas with CVD insert protection is measured relative to this base. Due to the discrete nature of the working surface of the diamond roller, linear wear is measured indirectly using a laminated witness on a DIP-3 microscope with an accuracy of ±2 μm. It is appropriate to record he relative values to the initial R_{L0} and R_{R0} instead of the absolute current values of R_L and R_R. The absolute depression δ and radii are measured during the processing (scaling adjustments, etc.) of the photographs (in electronic form) of the respective profiles made with the DIP-3 microscope.

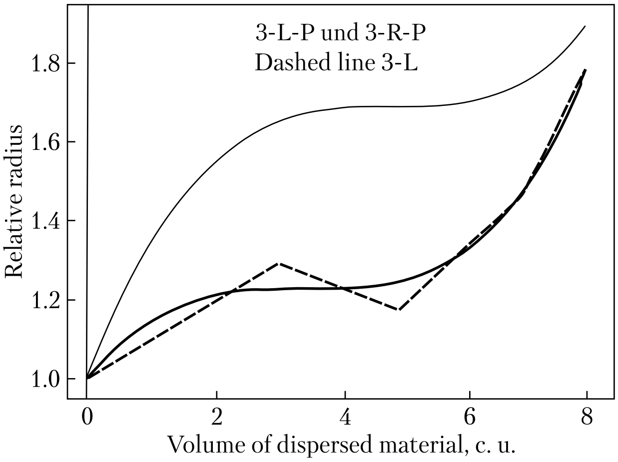


Fig. 8. Dependence of the apex relative rounding radius on the number of CVD inserts: $n = 16$ (upper curve 3-R-P — approximation) and $n = 32$ (dashed line 3-L — input data and 3-L-P — approximation) as a function of the volume of dispersed abrasive material of the wheels (c. u.). Wheel material: 25AF40O6V (40CT1)

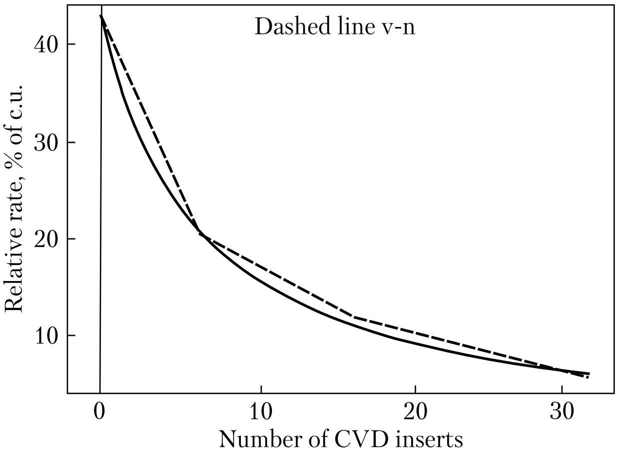
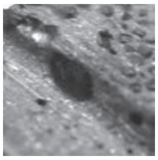
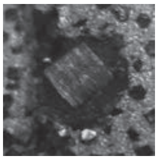
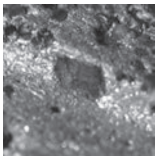
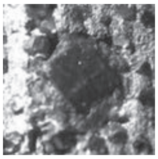
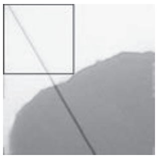
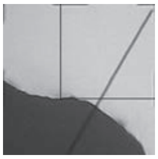
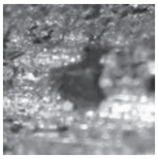
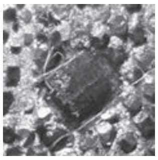


Fig. 9. Dependence of the relative blunting rate of the apexes (% of conventional unit of dispersed abrasive material) on the number of CVD inserts at a fixed volume (6 conventional units) of the specified material (dashed line — input data, curve — approximation). Wheel material: 25AF40O6V (40CT1)

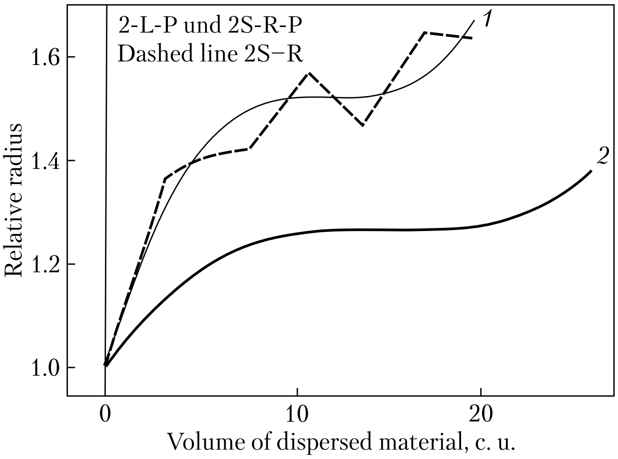
The relative rounding radii of the apexes are presented as a function of the volume of dispersed abrasive material from the wheels, with the volume measured in conventional units for clarity: one conventional unit corresponds to the volume

Table 2. **Excerpt from the Summary Table of Apex Wear**

Plate witness No.*	Volume of dispersed abrasive material of wheel 40CT1, (c.u.)	Photograph of recorded inserts numbered (No.)	Apex wear parameters			
			Left edge (with 6 inserts)		Rights edge (no inserts)	
			Photograph by microscope DIP-3		Photograph by microscope DIP-3	
			Apex depression δ, μm	Apex rounding radius R, μm	Apex depression δ, μm	Apex rounding radius R, μm
0	0.50 Actual additional opening under conditions of 5 μm, counter-feed	 No. 1  No. 6	62 	149	70 	168
3	3.37 Measured starting from No. 0 under normal operating conditions	 No. 1  No. 6	97 	234	82 	199
4	4.66 Measured starting from No. 0 under normal operating conditions	–	198 	478	155 	374
6	6.74 Measured starting from No. 0 under normal operating conditions	 No. 1  No. 6	173 	417	263 	634
			212	512	303	732

* Plate witness refers to a metal plate that transfers the actual profile of the roller through the abrasive wheel trued by this roller (a common practice for dimension control: the roller cuts the profile into the wheel, and the wheel transfers it onto the metal plate; explanation provided above).

** The inserts are assigned individual identification numbers to track the evolution of their wear.



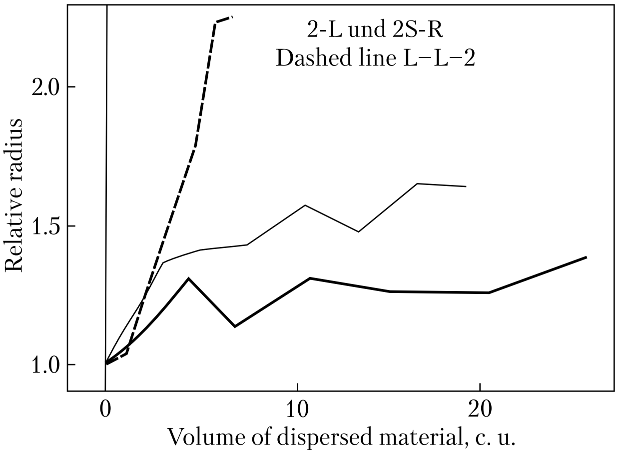


Fig. 10. Dependence of the apex relative rounding radius on the volume of dispersed abrasive material of the wheels (in conventional units). Number of CVD inserts $n = 6$. Wheel material: *1* — 25AF60P6V (25CT2), dashed line 2S−R (input data) and upper curve 2S−R−P (approximation); *2* — 25AF60L7V (25CM2), curve 2−L−P (approximation)

Fig. 11. Dependence of the apex relative rounding radius on the volume of dispersed abrasive material of the wheels (in conventional units). The number of CVD inserts $n = 6$, wheel material P (CT2). Grain sizes: *1* — 25 (middle dashed line 2S−R); *2* — 40 (upper dashed line 1−L−2). For comparison, material 25AF60L7V (25CM2) corresponds to the lower dashed line 2−L in the graph

of one linear millimeter of a Ø600 wheel. For this purpose, primary data have been analyzed and processed, including photographs of CVD inserts on the working surface of the truing rollers at various wear stages. Summary tables of apex wear have been constructed, with a typical example shown below (Table 2).

The processing of experimental data has demonstrated that the use of CVD inserts in highly loaded areas of the truing tool significantly enhances the dimensional stability of the working profile and that the wear of CVD diamonds, like that of HPHT crystals, under conditions of truing abrasive wheels with a ceramic bond, exhibits the characteristics of abrasive wear.

An analysis of the relationships between the dimensional stability of the working profile and the design parameters of the roller and abrasive wheel is presented below.

First, the relative (dimensionless) values of the radii as a function of the volume of dispersed abrasive material from the trued wheels exhibit an S-shaped graph (Figs. 8 and 10). Second, the relative values of the radii as a function of the number of CVD inserts at a fixed volume (6 a.u.) of dispersed abrasive material from the trued wheels display a decreasing trend (Fig. 9).

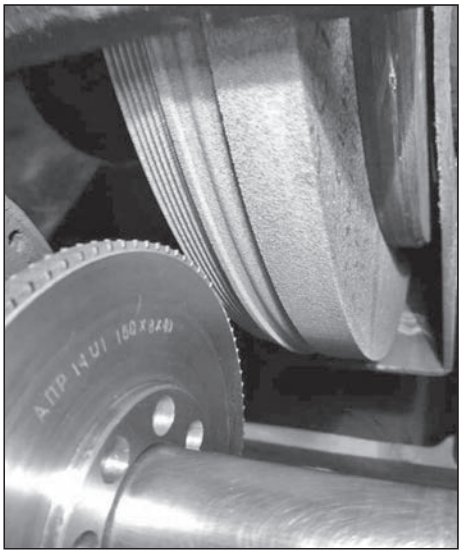


Fig. 12. CVD-diamond roller during the truing of a grinding wheel

Third, the comparative graphs (Fig. 10) of the changes in relative radii corresponding to different hardness levels of abrasive wheels (under identical conditions) indicate that an increase in wheel hardness by one grade increases the rate of linear wear (or the growth of the relative rounding radius of the apex, as in our case) by $(1.47 - 1.22)/4 = 6.25 \times 10^{-2}$, or 6.25% per unit.

Fourth, the comparative graphs (Fig. 11) of the changes in conditional radii corresponding to different grain sizes of abrasive wheels (under identical conditions) demonstrate that an increase in the grain size by a grade increases the growth rate of the relative rounding radius of the apex by $(2.23 - 1.47)/2 = 38 \times 10^{-2}$, or 38% per unit.

For industrial trials of the truing tool with CVD diamonds, samples of truing rollers with a diameter of 150 mm are designed and manufactured for the truing of gear-grinding wheels. The truing roller contains 180 CVD diamond crystals measuring $0.8 \times 0.8 \times 1.50.8$ mm (0.01 carats), arranged on both sides of the roller with 90 crystals per side, spaced at four-degree intervals (Fig. 12).

Thus, on the basis of the pilot production site at the Bakul Institute for Superhard Materials of the NAS of Ukraine, a batch of truing rollers with CVD diamonds has been manufactured using electroforming and tested under laboratory conditions simulating the environment of Ukrainian machine-building enterprises. This is the first such production in the country. The test results allow for a positive conclusion regarding the potential for import substitution of this tool to meet the needs of Ukrainian machine-building enterprises.

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CONFLICT OF INTERESTS

The authors declare no conflict of interest.

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ПІДВИЩЕННЯ ЗНОСОСТІЙКОСТІ СКЛАДНОПРОФІЛЬНИХ ДІЛЯНОК АЛМАЗНО-ГАЛЬВАНІЧНОГО ШАРУ ПРАВЛЯЧОГО ІНСТРУМЕНТУ КОМБІНУВАННЯМ CVD- ТА HPHT-АЛМАЗІВ

Вступ. На машинобудівних підприємствах України для правки сучасних абразивних кругів (при шліфуванні поверхонь обертання складнофасонних виробів) нині починають застосовувати імпортні правлячі ролики з CVD-алмазами. CVD (Chemical Vapour Deposition) — одна з нових технологій лабораторного отримання алмазних продуктів шляхом хімічного осадження з парової фази.

Проблематика. У процесі правки абразивних кругів традиційним алмазним правлячим інструментом диспергований абразивний матеріал активно вимиває зв’язку в місцях закладання синтетичних монокристалічних алмазів і останні випадають, не використавши свій ресурс. Витягнута форма CVD-алмазів і більш глибине закладання у зв’язці повинно стабілізувати утримання їх на робочій поверхні інструменту, збільшуючи таким чином ресурс правлячого інструменту.

Мета. Формування алмазно-абразивного шару інструменту методом гальванопластики через застосування суміші CVD- та HPHT-алмазів для підвищення зносостійкості складнопрофільних ділянок правлячого інструменту.

Матеріали й методи. Використано зерна алмазних порошків з CVD- та HPHT-алмазів. Елементний склад домішок і включень у порошках визначали за допомогою растрового електронного мікроскопу «BS-340» та енергодисперсійного аналізатора рентгенівських спектрів «Link-860».

Результати. Обробка експериментальних даних засвідчила, що застосування CVD-вставок у навантажених ділянках правлячого інструмента суттєво підвищує розмірну стійкість робочого профілю. Визначено, що зношування CVD-алмазів, як і кристалів HPHT, в умовах правки абразивних кругів на керамічній зв’язці, має характер абразивного зношування.

Висновки. Застосування в інструменті таких спрямовано поліпшених складнопрофільних ділянок сумішшю CVD- та HPHT-алмазів дозволяє підвищити ефективність роботи алмазного правлячого інструменту.

Ключові слова: прецизійний правлячий інструмент, шліфпорошки CVD- та HPHT-алмазів, алмазно-гальванічний шар, алмазний правлячий інструмент, зносостійкість складнопрофільних ділянок.