ISSN 2518-170X (Online)
ISSN 2224-5278 (Print)

ҚАЗАҚСТАН РЕСПУБЛИКАСЫ
ҰЛТТЫҚ ҒЫЛЫМ АКАДЕМИЯСЫ
Satbayev University

ХАБАРЛАРЫ

ИЗВЕСТИЯ

НАЦИОНАЛЬНОЙ АКАДЕМИИ
НАУК РЕСПУБЛИКИ
КАЗАХСТАН
Satbayev University

N E W S

OF THE ACADEMY OF SCIENCES
OF THE REPUBLIC OF
KAZAKHSTAN
Satbayev University

SERIES

OF GEOLOGY AND TECHNICAL SCIENCES

5 (455)

SEPTEMBER – OCTOBER 2022

THE JOURNAL WAS FOUNDED IN 1940

PUBLISHED 6 TIMES A YEAR

ALMATY, NAS RK

NAS RK is pleased to announce that News of NAS RK. Series of geology and technical sciences scientific journal has been accepted for indexing in the Emerging Sources Citation Index, a new edition of Web of Science. Content in this index is under consideration by Clarivate Analytics to be accepted in the Science Citation Index Expanded, the Social Sciences Citation Index, and the Arts & Humanities Citation Index. The quality and depth of content Web of Science offers to researchers, authors, publishers, and institutions sets it apart from other research databases. The inclusion of News of NAS RK. Series of geology and technical sciences in the Emerging Sources Citation Index demonstrates our dedication to providing the most relevant and influential content of geology and engineering sciences to our community.

Қазақстан Республикасы Ұлттық ғылым академиясы «ҚР ҰҒА Хабарлары. Геология және техникалық ғылымдар сериясы» ғылыми журналының Web of Science-тің жаңаланған нұсқасы Emerging Sources Citation Index-те индекстелуге қабылданғанын хабарлайды. Бұл индекстелу барысында Clarivate Analytics компаниясы журналды одан әрі the Science Citation Index Expanded, the Social Sciences Citation Index және the Arts & Humanities Citation Index-ке қабылдау мәселесін қарастыруда. Webof Science зерттеушілер, авторлар, баспашылар мен мекемелерге контент тереңдігі мен сапасын ұсынады. ҚР ҰҒА Хабарлары. Геология және техникалық ғылымдар сериясы Emerging Sources Citation Index-ке енуі біздің қоғамдастық үшін ең өзекті және беделді геология және техникалық ғылымдар бойынша контентке адалдығымызды білдіреді.

НАН РК сообщает, что научный журнал «Известия НАН РК. Серия геологии и технических наук» был принят для индексирования в Emerging Sources Citation Index, обновленной версии Web of Science. Содержание в этом индексировании находится в стадии рассмотрения компанией Clarivate Analytics для дальнейшего принятия журнала в the Science Citation Index Expanded, the Social Sciences Citation Index и the Arts & Humanities Citation Index. Web of Science предлагает качество и глубину контента для исследователей, авторов, издателей и учреждений. Включение Известия НАН РК. Серия геологии и технических наук в Emerging Sources Citation Index демонстрирует нашу приверженность к наиболее актуальному и влиятельному контенту по геологии и техническим наукам для нашего сообщества.

«ҚР ҰҒА Хабарлары. Геология және техникалық ғылымдар сериясы».
ISSN 2518-170X (Online),
ISSN 2224-5278 (Print)

Меншіктеуші: «Қазақстан Республикасының Ұлттық ғылым академиясы» РҚБ (Алматы қ.).

Қазақстан Республикасының Ақпарат және қоғамдық даму министрлігінің Ақпарат комитетінде 29.07.2020 ж. берілген **№ KZ39VPY00025420** мерзімдік басылым тіркеуіне қойылу туралы куәлік.

Тақырыптық бағыты: *геология, мұнай және газды өңдеудің химиялық технологиялары, мұнай химиясы, металдарды алу және олардың қосындыларының технологиясы.*

Мерзімділігі: жылына 6 рет.

Тиражы: 300 дана.

Редакцияның мекен-жайы: 050010, Алматы қ., Шевченко көш., 28, 219 бөл., тел.: 272-13-19

http://www.geolog-technical.kz/index.php/en/

Типографияның мекен-жайы: «Аруна» ЖК, Алматы қ., Мұратбаев көш., 75.

«Известия НАН РК. Серия геологии и технических наук».
ISSN 2518-170X (Online),
ISSN 2224-5278 (Print)

Собственник: Республиканское общественное объединение «Национальная академия наук Республики Казахстан» (г. Алматы).

Свидетельство о постановке на учет периодического печатного издания в Комитете информации Министерства информации и общественного развития Республики Казахстан **№ KZ39VPY00025420,** выданное 29.07.2020 г.

Тематическая направленность: *геология, химические технологии переработки нефти и газа, нефтехимия, технологии извлечения металлов и их соеденений.*

Периодичность: 6 раз в год.

Тираж: 300 экземпляров.

Адрес редакции: 050010, г. Алматы, ул. Шевченко, 28, оф. 219, тел.: 272-13-19

http://www.geolog-technical.kz/index.php/en/

Адрес типографии: ИП «Аруна», г. Алматы, ул. Муратбаева, 75.

News of the National Academy of Sciences of the Republic of Kazakhstan. Series of geology and technology sciences.
ISSN 2518-170X (Online),
ISSN 2224-5278 (Print)

Owner: RPA «National Academy of Sciences of the Republic of Kazakhstan» (Almaty).

The certificate of registration of a periodical printed publication in the Committee of information of the Ministry of Information and Social Development of the Republic of Kazakhstan **No. KZ39VPY00025420,** issued 29.07.2020.

Thematic scope: *geology, chemical technologies for oil and gas processing, petrochemistry, technologies for extracting metals and their connections.*

Periodicity: 6 times a year.

Circulation: 300 copies.

Editorial address: 28, Shevchenko str., of. 219, Almaty, 050010, tel. 272-13-19

http://www.geolog-technical.kz/index.php/en/

Address of printing house: ST «Aruna», 75, Muratbayev str, Almaty.

NEWS *of the National Academy of Sciences of the Republic of Kazakhstan*
SERIES OF GEOLOGY AND TECHNICAL SCIENCES
https://doi.org/10.32014/2518-170X.233

UDC 621.09.1

K.T. Sherov[1*], A.K. Rakishev[2], B.N. Absadykov[3], M.R. Sikhimbayev[4], A. Esirkepov[1]

[1]S. Seifullin Kazakh Agro Technical University, Astana, Kazakhstan;
[2]A. Saginov Karaganda Technical University, Karaganda, Kazakhstan;
[3]A.B. Bekturov Institute of Chemical Sciences, Almaty, Kazakhstan;
[4]Karaganda Economic University of Kazpotrebsoyuz, Karaganda, Kazakhstan.
E-mail: *shkt1965@mail.ru*

EXPERIMENTAL STUDY OF CHIP FORMATION DURING ROTARY-FRICTION TURNING OF PARTS TYPE OF ROTATION BODIES FROM VARIOUS MATERIALS

Abstract. In the conditions of repair and mechanical production of chemical, oil, geological exploration and other sectors of the national economy of the Republic of Kazakhstan, there is a problem of improving the quality indicators and productivity of cutting in the manufacture of parts of bodies of revolution from various materials. The authors investigated the method of rotational friction turning of external cylindrical surfaces using a special cutting tool - a friction cup cutter.

For processing by rotational friction turning, samples were prepared - blanks of various diameters and materials: steel 45, steel 20X, brass L63 and bronze BrAMts9-2. The workpiece samples were processed on 1K62 and JET GH-1640ZX screw-cutting lathes.

As a result of processing by rotational friction turning, various forms of chips were obtained. When processing steel 20X, two types of chips were obtained: fracture chips and shearing chips. When processing steel 45, drain chips of various lengths were obtained.

On the basis of metallographic studies of chip formation and the nature of the distribution of deformations in the chip formation zone, it was established that plastic deformation during rotational friction turning obeys the laws of traditional cutting. When machining non-ferrous metals, you can control the shape and size of the chips formed. The results obtained showed the wide technological

possibilities of the developed resource-saving method of rotational-frictional turning of parts of bodies of revolution.

Key words. Rotational-friction turning, chip formation, cup cutter, build-up, angle of tool setting, deformation, shear plane.

К.Т. Шеров[1*], А.К. Ракишев[2], Б.Н. Абсадыков[3], М.Р. Сихимбаев[4], А. Есиркепов[1]

[1]С. Сейфуллин атындағы Қазақ агротехникалық университеті, Астана, Қазақстан;
[2]А. Сағынов атындағы Қарағанды техникалық университеті, Қарағанды, Қазақстан;
[3]Ә.Б. Бектұров атындағы химия ғылымдары институты, Алматы, Қазақстан;
[4]Қазтұтынуодағы Қарағанды экономикалық университеті, Қарағанды, Қазақстан.
E-mail: *shkt1965@mail.ru*

ӘРТҮРЛІ МАТЕРИАЛДАРДАН ЖАСАЛҒАН АЙНАЛУ ДЕНЕЛЕРІ ТИПТЕС ТЕТІКТЕРДІ РОТАЦИЯЛЫҚ-ФРИКЦИЯЛЫҚ ЖОНУ КЕЗІНДЕ ЖОҢҚАЛАРДЫҢ ТҮЗІЛУІН ЭКСПЕРИМЕНТТІК ЗЕРТТЕУ

Аннотация. Қазақстан Республикасының химия, мұнай, геологиялық барлау және басқа да халық шаруашылығы салаларының механикалық-жөндеу өндірістері жағдайында, әртүрлі материалдардан жасалған айналушы дене тетіктерін даярлау кезінде, кесумен өңдеу сапа көрсеткіштерін және өнімділігін арттыру мәселесі орын алып отыр. Авторлар арнайы кесу құралы –фрикциялық табақшалы кескішті қолдана отырып, сыртқы цилиндрлік беттерді ротациялық-фрикциялық жону әдісін зерттеді. Ротациялық-фрикциялық жону арқылы өңдеу үшін әртүрлі диаметрлер мен материалдардан жасалған дайындама үлгілері дайындалды: болат 45, болат 20Х, жез L63 және қола БрАМц9-2. Дайындама үлгілерін өңдеу 1К62 және JET GH-1640ZX бұранда кесуші білдектерде жүргізілді. Ротациялық-фрикциялық жону арқылы өңдеу нәтижесінде жоңқаның әртүрлі формалары алынды. Болат 20Х материалын өңдеу кезінде жоңқаның екі түрі алынды: сынық жоңқа және омырылу жоңқасы. Болат 45 материалын өңдеу кезінде әртүрлі ұзындықтағы иірмелі жоңқалар алынды. Жоңқалардың пайда болуын металлографиялық зерттеулер мен жоңқалардың пайда

болу аймағындағы деформациялардың таралу сипатына сүйене отырып, ротациялық-фрикциялық жону кезіндегі пластикалық деформация дәстүрлі кесу заңдылықтарына бағынады, сонымен қатар қайталама пластикалық деформациялар аймағының көлемін едәуір төмендететіндігі анықталды. Түсті металдарды өңдеу кезінде құралды орнату бұрышының оңтайлы мәнін және кесу режимдерін таңдау нәтижесінде пайда болған жоңқаның пішіні мен мөлшерін басқаруға болатындығы анықталды. Кесу режимдерінің оңтайлы мәндерін және құралды орнату бұрышын таңдағанда, пластикалық деформация негізінен «құрал-дайындама» түйісу қабатында жүретіні анықталды және бұл ротациялық-фрикциялық жону тәсілін жүзеге асырудағы негізгі ұтымдылығы болып табылады. Алынған нәтижелер ротациялық-фрикциялық жону тәсілінің үнемшіл және кең технологиялық мүмкіндікке ие екенін көрсетті.

Түйін сөздер: ротациялық-фрикциялық жону, жоңқа қалыптасуы, табақшалы кескіш, өсімше, құралды орнату бұрышы, деформация, ығысу жазығы.

К.Т. Шеров[1*], А.К. Ракишев[2], Б.Н. Абсадыков[3], М.Р. Сихимбаев[4], А. Есиркепов[1]

[1]Казахский агротехнический университет им. С. Сейфуллина, Астана, Казахстан;
[2]Карагандинский технический университет им. А. Сагинова, Караганда, Казахстан;
[3]Институт химических наук имени А.Б. Бектурова, Алматы, Казахстан;
[4]Карагандинский экономический университет Казпотребсоюза, Караганда, Казахстан.
E-mail: *shkt1965@mail.ru*

ЭКСПЕРИМЕНТАЛЬНОЕ ИССЛЕДОВАНИЕ СТРУЖКООБРАЗОВАНИЯ ПРИ РОТАЦИОННО-ФРИКЦИОННОМ ТОЧЕНИИ ДЕТАЛЕЙ ТИПА ТЕЛ ВРАЩЕНИЯ ИЗ РАЗЛИЧНЫХ МАТЕРИАЛОВ

Аннотация. В условиях ремонтно-механических производств химической, нефтяной, геологоразведочной и других отраслей народного хозяйства Республики Казахстан существует проблема повышения качественных показателей и производительности обработки резанием при изготовлении деталей тел вращения из различных материалов.

Авторами исследован способ ротационно-фрикционного точения наружных цилиндрических поверхностей с использованием специального режущего инструмента – фрикционного чашечного резца. Для обработки ротационно-фрикционным точением были подготовлены образцы – заготовки из различных диаметров и материала: сталь 45, сталь 20Х, латунь Л63 и бронза БрАМц9-2. Обработка образцов-заготовок производилась на токарно-винторезных станках 1К62 и JET GH-1640ZX. В результате обработки ротационно-фрикционным точением были получены различные формы стружек. При обработке стали 20Х получено два вида стружки: стружка надлома и скалывания. При обработке стали 45 получили сливные стружки различной длины. На основе металлографических исследований стружкообразования и характера распределения деформаций в зоне стружкообразования установлено, что пластическое деформирование при ротационно-фрикционном точении подчиняется закономерностям традиционного резания, а также самовращение ротационно-фрикционного инструмента, значительно уменьшающее размеры области вторичных пластических деформаций, не исключает наростообразования. Также было установлено, что при обработке цветных металлов подбором оптимального значения угла установки инструмента и режимов резания можно управлять формой и размерами образуемой стружки. Установлено, что при выборе оптимальных значений режимов резания и угла установки инструмента пластическая деформация протекает в основном в контактном слое «инструмент-заготовка», что является основным эффектом реализации способа ротационно-фрикционного точения. Полученные результаты показали широкие технологические возможности разрабатываемого ресурсосберегающего способа ротационно-фрикционного точения деталей тел вращения.

Ключевые слова: ротационно-фрикционное точение, стружкообразование, чашечный резец, нарост, угол установки инструмента, деформация, плоскость сдвига.

Introduction. The problems of increasing the quality indexes and the productivity of cutting processing increase due to the use in modern production of automated process equipment with a higher precision of operation and, accordingly, with high precision of manufacturing their parts. Especially this problem is shown in the manufacture of parts of bodies of revolution in the conditions of modern engineering of the Republic of Kazakhstan.

The authors studied the method of rotational-friction turning of external cylindrical surfaces using a special cutting tool-a friction cup cutter (Sherov, et al., 2020 a:9, Sherov, et al., 2017 b:14, Khodzhibergenov, et al., 2015 a:3, Sherov, et al., 2020 c:4, Dudak et al., 2020 a:12).

It is known that a large reserve of increasing the productivity of the process, improving the quality of the treated surfaces is embedded in the methods of rotary cutting, in which the cutting tools use cup cutters rotating in the process of cutting around their axes.

The principal feature of rotary cutting is laid in the sharp decrease in the sliding speeds of the working surfaces of the tool relative to the machining material without reducing the speed of the relative movement of the tool and workpiece by replacing the sliding friction in the contact zones with the rolling friction (Konovalov, et al., 1972:272, Gik, 1990:254, Yashcheritsyn, et al., 1987:229, Balgabekov, et al., 2014 a:4, Dudak et al., 2020 b:8).

However, this method has not found wide application in production because of the high cost of manufacturing a cup cutter, which is made entirely of tool materials (high-speed steels, hard alloys). And also when it is chipped or worn, it is necessary to replace or re-sharpen the cup cutter. The re-sharpening of the cup cutter is a labor-intensive process, as its manufacture. The main difference between the developed method of rotational-friction turning of external cylindrical surfaces is the use of a special rotational-friction cup cutter made of non-instrumental material. When developing new cutting methods, the study and investigation of the process of chip formation has both scientific-theoretical and practical significance.

Moreover, the cutting process is a set of extremely complex phenomena that depend on the physico-mechanical properties of machined material, which is accompanied by plastic and elastic deformations, destruction, friction and heat release (Nasad, et al., 2019 a:7, Zubkov, 2003:6, Petrushin, 2014:307, Kurmangaliyev, et al., 2018:8, Rakhimov, et al., 2021:9). More than 90% of the force and cutting work is expended on the chip formation process, respectively, most of the heat released during chip formation (Bobrov, et al., 1980:3, Kadyrov, et al., 2021 a:9, Nasad, et al., 2019 b:4, Togizbayeva, et al., 2020:9).

This process depends on the thermal regime and contact loads on the working surfaces of the tool, hence the intensity and nature of their wear (Grigoriev, 2009:368, Gurevich, 1980:3, Loladze, 1982:320, Mukanov, et al., 2019:4).

There are the quality of the surface layer and the accuracy of the workpiece in direct connection with the chip formation process. Thus, almost all the characteristics of the cutting process and its practical results depend on the chip-forming process. The flow of this process is mainly determined by the deformed state of the chip formation zone (Khodzhibergenov, et al., 2019 b:4, Zhunusbekova, et al., 2016:4, Ganyukov, et al., 2018:12, Balgabekov, et al., 2014 b:3, Balgabekov, et al., 2013 c:3).

In connection with the foregoing, the work aimed at investigating the mechanism of chip formation, the deformed state of the processed material and the cut layer, as well as the regularities and phenomena occurring in the process of rotational-friction turning, is an actual task.

Research materials and methods. The tasks set in the work were solved by experimental and theoretical methods. In theoretical studies, the main provisions of the theory of material cutting, the theory of plasticity and elasticity, the theory of chip formation, the technology of metals and materials science are applied. In the experimental studies the metallographic method of investigation is applied.

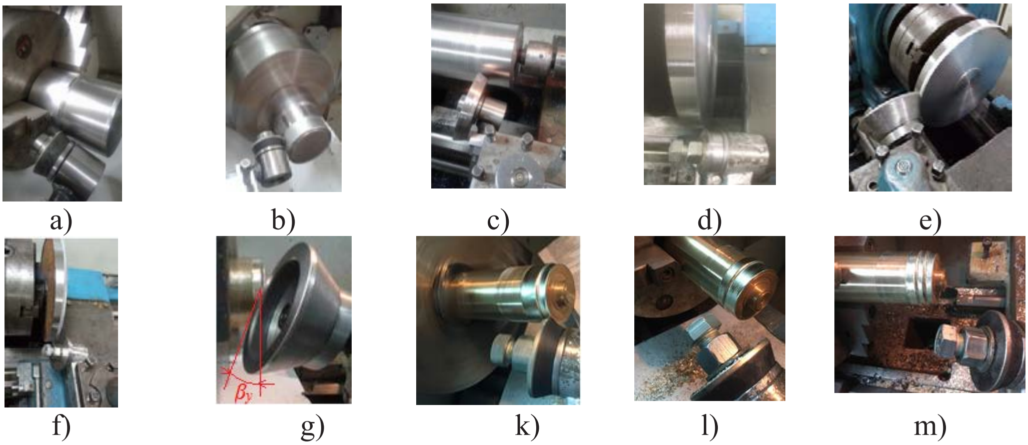
The processing of samples by rotational-frictional turning was performed on a lathe with the use of rotational friction cup cutters of various diameters and made of various non-instrumental materials. Figure 1 shows the constructions of the applied rotational-friction tools.

a) b) c) d) e)

a – cup cutter made of HARDOX steel; b - cup cutter made of 65Г; c,e - cup cutter made of 20X; d - cup cutter made of DI40 (Ductile iron)

Figure 1. Constructions of applied rotational-friction tools

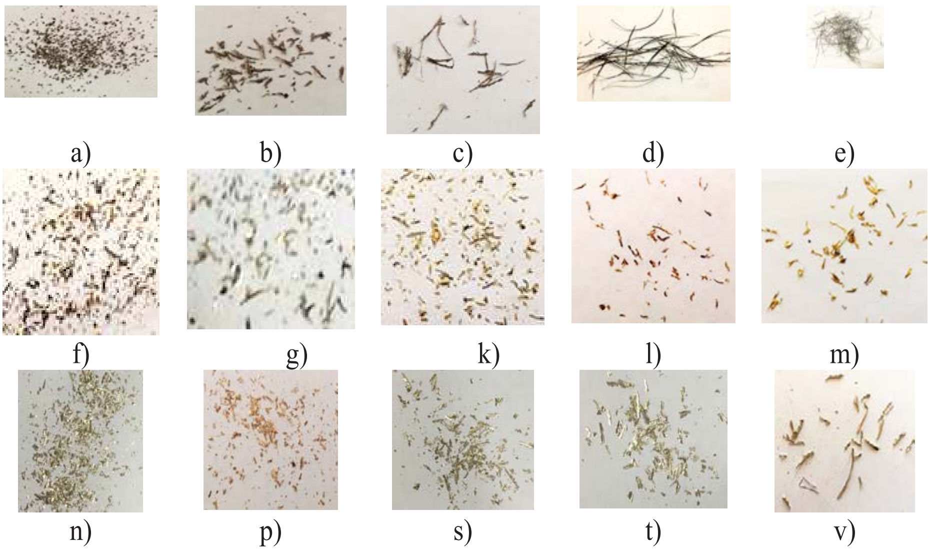
Results. For the treatment by rotational-frictional turning, specimens were prepared - workpieces from various diameters and material: сталь 45, steel 20X, brass L63 and bronze BrAMts9-2. Processing of samples- workpiece was made on cutting lathes 1K62 and JET GH-1640ZX. Figure 2 shows photographs of the process of rotational-friction turning.



a, b – steel processing 20X, Ø120 mm; c – steel processing 45, Ø180 mm; d,e,f - steel processing 45, Ø240 mm; g - brass processing process L63; k,l,m - bronze processing process BrAMts9-2; $\beta_{s.a}$ – tool setting angle

Figure 2. Photographs of the process of rotational-friction turning

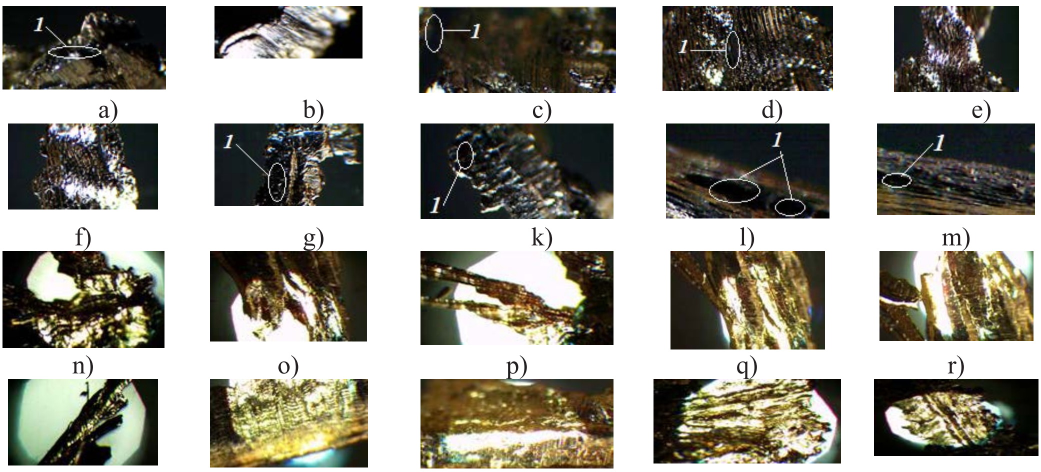
When machining by rotational-frictional turning, the cutting regimes varied: n_{sp} = 265÷1800 rpm; n_{tool}=217÷1473 rpm; $\beta_{s.a}$ =25^0; S=0,038÷2.3 mm/rev; t=1÷2 mm; $\beta_{s.a}$ = 5^0÷35^0. Figure 3 shows photographs of chips obtained with different rotational-friction turning modes of steel 20X and steel 45.



a, b – chips obtained in processing steel 20X, Ø120 mm; c,d,e - chips obtained in processing steel 45, Ø240 mm; f,g,k,l,m - chips obtained in processing brass L63; n,p,s,t,v - chips obtained in processing bronze BrAMts9-2

Figure 3. Photographs of chips obtained with different rotational-friction turning modes of various materials

As a result of the rotational-frictional treatment, various forms of chips were obtained. When machining with different cutting modes and the angles of tool placement, the process of chip formation is of a different nature and a different type of chips are obtained. When processing steel 20X, two types of chips were obtained: chips of the fracture (fig. 3a) и shearing (fig. 3b). Fracture chips were formed during the processing of steel 20X (fig. 2b) and the treated surface was rough. This is due to the fact that during the cutting process, sufficient conditions were not created for the appearance of plastic deformation and the surface layer was pulled out by the cutting part of the tool. Shearing chips were formed during the processing of steel 20X (fig. 2a) and the treated surface turned out to be less rough, and also this kind of chips is inherent in alloyed steels. When processing steel 45 (fig. 2 c,d,e) obtained continuous chips of different lengths. The largest and longest continuous chip (fig. 3d) was obtained by processing steel 45 (fig. 2d) by tool installed at an angle $\beta_y = 20^0$. The results show that with properly selected cutting modes and in particular the correct selection of the tool mounting angle, it is possible to provide the necessary condition for the cutting process to be performed in the rotational friction turning. The metallographic study of the obtained chips was carried out using the equipment of the laboratory of the "International Material Science Center" of Karaganda Technical University. Figure 4 shows micrographs of chips obtained with the help of the universal metallographic microscope Altami MET 5T.



a,b,c – micrographs of chips shown in fig. a; d,e,f – micrographs of chips shown in fig.4b; g,k – micrographs of chips shown in fig.4c; l,m – micrographs of chips shown in fig.4d; n,o,p,q,r,s – micrographs of chips of brass L63; t,w,x,z - micrographs of chips of bronze BrAMts9-2; 1-build-up

Figure 4. Microphotographs of chips obtained with the help of the universal metallographic microscope Altami MET 5T

Discussion. On these microphotographs, with an increase in x50, the growths are clearly visible (fig.4 a,c,c,g,l,m). Studies have shown that at first small growths are formed, the number of which sharply fluctuates, rapidly increase in size and turn into a large growth. The increase in the size of the o build-ups and their transformation into a large growth is associated with the conditions of friction on the front surface of the tool. The formation of growths in the process of rotational-frictional turning can be explained by a decrease in the frictional force. Since the traditional method of rotary cutting involves replacing sliding friction in contact zones with rolling friction, which helps reduce the frictional force in the tool-workpiece contact. This situation is contrary to the cutting mechanism of the proposed method. For cutting and stopping the build-up, it is necessary that the chip material, which is near the point of contact with the tool and which is the raw material for the build-up, softens, becomes very plastic. This can be achieved by increasing the degree of deformation of the contacting chip layer with the tool, thereby increasing the amount of heat released due to plastic deformation and cutting temperature. And also by increasing the frictional force in the tool-workpiece contact by selecting the optimum values for the tool setting angle and the cutting modes. The results of the study showed that with increasing cutting and feeding speeds, the build-up size decreases or disappears altogether. In this case, the rational value of the tool setting angle is determined $\beta_{s.a} = 20^0$. Metallographic studies showed uneven deformation of chips along their length (fig.4), i.e. The process of chip formation occurs from the moment of formation of the shear plane, therefore the deformations of elementary volumes of chips located at this plane are approximately the same. The exception is the areas located in the immediate vicinity of the cutting edge, but their value is small. Therefore, in the first approximation, we can assume that the deformation temperature and the strain energy are distributed uniformly on both sides of the shear plane. Rotation of the rotational-friction tool promotes an insignificant increase in the angle of shear, lying within the range of 3°-6°, depending on the value of the angle of installation of the tool. It is characteristic that the intensification of the localization of deformations is accompanied by a disturbance in the stability of the process by vibrations, one of the reasons for which is the unevenness of the rotation of the rotational-friction tool. When processing non-ferrous metals, an increase in the speed of rotational-friction turning can lead to a greater chip breaking (fig. 4 r,s,t), which adversely affects the quality of the treated surface. It is established that an increase in the angle of tool placement during processing of non-ferrous metals has a favorable effect on the process of cutting and chip formation. As the shape of the chips increases with the increase in the installation angle, and thus a condition is created for the free exit of the chips (without sticking). However, it must be taken into account that an excessive increase in the angle of installation can lead to a decrease in the plasticity of copper alloys, which contributes in the course of their deformation to the development of advanced micro and macrocracks (fig. 4 o,p,r,t,z). Also, in the formed chips, cracks were observed (fig. 4 t,x,z) dividing it into deformed elements which are firmly bound by a thin and strongly deformed contact layer. The formation of such chips is explained by the fact that when choosing the optimal values for the cutting conditions and the angle of tool placement, the plastic deformation proceeds mainly in the contact layer "tool-workpiece", which is the main effect of the implementation of the rotational-friction turning method.

Conclusions. It was found that the self-rotation of a rotational-friction tool, which significantly reduces the dimensions of the region of secondary plastic deformations, does not exclude the build-up: at low cutting speeds, a small build-up can occur near the exit point of the cutting edge from the cutting zone. However, with increasing cutting and feeding speeds, the dimensions of the build-up diminish or disappear altogether.

The results of experimental experiments have shown the possibility of processing by the method of rotational-friction turning of non-ferrous metals, in particular brass L63 and bronze BrAMts9-2. It was experimentally established that:

- increasing the feed reduces the cutting process, and reducing the feed reduces the processing capacity. Proceeding from this, the optimum cutting regimes were determined: for turning brass L63 - n=870 rpm; S=0,152 mm/rev; for turning bronze BrAMts9-2 - n=660 rpm; S=0,114 mm/rev;

- when processing non-ferrous metals, selecting the optimal setting angle and cutting modes, it is possible to control the shape and size of the formed chips. Optimal installation angle for bronze processing BrAMts9-2 defined angel $\beta_{s.a}$ $=15^0$, and for the processing of steel 45 and 20X the rational value of the tool setting angle is defined $\beta_{s.a} = 20^0$.

Information about the authors:

Sherov Karibek Tagayevich – Doctor of Engineering Sciences, Professor, S. Seifullin Kazakh Agro Technical University, Nur-Sultan, Kazakhstan, E-mail: *shkt1965@mail.ru*, ORCID: *https://orcid.org/0000-0003-0209-180X*;

Rakishev Aset Karigulovich – PhD, Senior Lecturer, A. Saginov Karaganda technical university, Karaganda, Kazakhstan. E-mail: *r_asset@mail.ru* , ORCID: *https://orcid.org/0000-0001-9535-4108*;

Absadykov Bakhyt Narikbayevich – Doctor of Technical Sciences, Professor, the Corresponding member of National Academy of Sciences of the

Republic of Kazakhstan, A.B. Bekturov Institute of Chemical Sciences, Almaty, Kazakhstan, E-mail: *b_absadykov@mail.ru*, ORCID: *https://orcid.org/0000-0001-7829-0958*;

Sikhimbayev Muratbay Ryzdikbayevich – Doctor of Economic Sciences, Professor, Karaganda economic university of Kazpotrebsoyuz, Karaganda, Kazakhstan, E-mail: *smurat@yandex.ru*, ORCID: *https://orcid.org/0000-0002-8763-6145*;

Esirkepov Azimbek – doctoral student, S. Seifullin Kazakh Agro Technical University, Technical faculty, Nur-Sultan, Kazakhstan, E-mail: *azimbek.esirkepov@mail.ru*; ORCID: *https://orcid.org/0000-0003-3098-2853*.

REFERENCES

Balgabekov T.K., *Baissanov S.O.*, *Issin D.K.*, *Baissanov A.S.*, *Issin B.D. (2014)* Studying properties of carbonaceous reducers and process of forming primary titanium slags. *Metalurgijathis link is disabled*, 53(4), стр. 581–584. (in Eng.).

Bobrov V.F., Eremina A.M. (1980) To the question of the physical nature of the layer located under the contact surface of the shavings. - Bulletin of mechanical engineering, No. 2, p. 25-27. (in Rus.).

Balgabekov T.K., *Issin D.K.*, *Kimanov B.M.*, *Akashev A.Z.*, *Issin B.D. (2014)* Studying and improving blast furnace cast iron quality / *Metalurgija*, 53(4), стр. 556–558. (in Eng.).

Balgabekov T., *Tolymbekov M.*, *Isagulov A.*, *Michot G.*, *Azbanbayev E. (2013)* Effect of pressure during impulse compaction on the strength of the molding sand mixture. Metalurgia International, 18(12), стр. 48–50. (in Eng.).

Dudak N., Itybayeva G., Kasenov A., Mussina Zh., Taskarina A., Abishev K. (2019) Multi-ute drill-broach for precision machining of holes / Scientia Iranica, Transactions B: Mechanical Engineering 26, P.1415-1426. DOI: *https://doi.org/10.24200/sci.2018.5623.1379* (in Eng.).

Dudak N., Taskarina A., Kasenov A., Itybaeva G., Mussina Z., Abishev K., Mukanov R. (2017) Hole Machining Based on Using an Incisive Built-Up Reamer // International Journal of Precision Engineering and Manufacturing, Volume 18, Issue 10, Pages 1425-1432. *https://doi.org/10.1007/s12541-017-0170-9* (in Eng.).

Gik L.A. (1990) Rotary Metal Cutting – Kaliningrad: Book Publishing House, – pp. 254. (in Russian).

Grigoriev S.N. (2009) Methods for increasing the durability of cutting tools: a textbook for university students. - M.: Mashinostroenie.- 368 p. (in Rus.).

Gurevich D.M. (1980) Wear mechanism of titanium-tungsten hard alloy. - Bulletin of mechanical engineering, No. 11, p. 41-43. (in Rus.).

Ganyukov A.A., Kadyrov A.S., Balabekova K.G., Kurmasheva B.K. (2018) Tests and calculations of structural elements of temporary bridges / Roads and Bridges - Drogi i Mosty 17 215 - 226 DOI: 10.7409/rabdim.018.014 (in Eng.).

Khodzhibergenov D.T., Esirkepov A., Sherov K.T. (2015) Rational milling of metals / Russian Engineering Research. Allerton Press, Inc. Vol. 35. No 1. pp. 43-45. *https://doi.org/10.3103/s1068798x1501013x* (in Eng.).

Konovalov E.G. (1972) Efficient circuits of rotary metal cutting / E.G. Konovalov, V.A. Sidorenko, A.V. Sous. – Minsk: Science and Engineering, – pp. 272. (in Rus.).

Kurmangaliyev T.B., Sherov K.T., Sikhimbayev M.R., Absadykov B.N., Sikhimbayeva

D.R., Musaev M.M., Mazdubai A.V. (2018) Experimental study of optimal parameters of pneumatic motor of vibration table for inertial vibroabrasive machining the parts on the basis of beryllium oxide / News of the Academy of Sciences of the Republic of Kazakhstan, Kazakh national research technical university named after K.I. Satpayev. Series of Geology and technical sciences, №5 (431) – P.184-191. *https://doi.org/10.32014/2018.2518-170X.24* (in Eng.).

Kadyrov A., Zhunusbekova Zh., Ganyukov A., Kadyrova I., Kukesheva A. (2021) General Characteristics for Loading the Working Elements of Drilling and Milling Machines when Moving in the Clay Solution // Communications - Scientific Letters of the University of Zilina. - Vol. 23, no. 2. - P. B97-B105. DOI: *https://doi.org/10.26552/com.C.2021.2.B97-B105* (in Eng.).

Khodzhibergenov D.T., Ibragimova Z.A., Khodzhibergenova U.D. *Abdukarimov A., Esirkepov A.* (2019) Some aspects of software in cutting tools designing and testing / Russian Engineering Research. Vol. 39. pp 772-775. *https://doi.org/10.3103/S1068798X19090090* (in Eng.).

Loladze T.N. (1982) Strength and wear resistance of the cutting tool - M.: Mashinostroenie.320 p. (in Russian).

Mukanov R.B., Kasenov A.Z., Itybaeva G.T., Musina Zh.K., Abishev K., Bykov P.O. (2019) Face Turning of Holes // Russian Engineering Research, Volume 39, Issue 1, Pages 75-78. DOI: 10.3103/S1068798X19010064 (in Eng.).

Nasad T.G., Sherov K.T., Absadykov B.N., Tusupova S.O., Sagitov A.A., Abdugaliyeva G.B., Okimbayeva A.E. (2019) Formation management in parts processing regenerated by surfacing // News of the National Academy of Sciences of the Republic of Kazakhstan. Series of geology and technical sciences. Vol. 3, N 435. P. 102-108. *https://doi.org/10.32014/2019.2518-170x.74* (in Eng.).

Nasad T.G., Kochetkov A.V. (2016) Highly Efficient Methods of Machining Titanium for Oil-Gas Drilling Equipment. Chem Petrol Eng 52: 227–230. *https://doi.org/10.1007/s10556-016-0179-4* (in Eng.).

Petrushin S.I. (2014) Theoretical foundations of optimization of the cutting part of blade tools: diss. doct. tech. Sciences: 05.03.01/Petrushin Sergey Ivanovich. - MSTU im. N.E. Bauman, Moscow - 307 p. (in Rus.).

Rakhimov M.A., Rakhimova G.M., Suleimbekova Z.A. (2021) Modification of Concrete Railway Sleepers and Assessment of Its Bearing Capacity International Journal of GEOMATE, 20(77), pp.40-48. DOI:*https://doi.org/10.21660/2020.77.01916* (in Eng).

Sherov K.T., Sikhimbayev M.R., Nasad T.G., Absadykov B.N., Izotova A.S., Okimbayeva A.E., Kuanov I.S. (2020) The research of the steel cutting blade reliability for thermo-frictional processing // News of the National Academy of Sciences of the Republic of Kazakhstan. Series of geology and technical sciences. Volume 1, Number 439, P.122 – 130. *https://doi.org/10.32014/2020.2518-170X.15* (in Eng.).

Sherov K.T., Sikhimbayev M.R., Donenbayev B.S., Sagitov A.A., Ainabekova S.S. (2017) Experimental Research of Rotational-and-Frictional Boring of Big Holes in Large Parts / Journal of Theoretical and Applied Mechanics, Sofia, Vol. 47, No. 4 - P. 23-36. *https://doi.org/10.1515/jtam-2017-0018* (in Eng.).

Sherov K.T., Ainabekova S.S., Tusupova S.O., *Sagitov* A.A., *Imanbaev* E.B. (2020) Thermofrictional Cutting with Pulsed Cooling. / Russ. Engin. Res. 40, 926–929. *https://doi.org/10.3103/S1068798X20110179* (in Eng.).

Togizbayeva B.B., *Sazambayeva B.T.*, *Karazhanov A.A.*, *Kenesbek A.B.*, *Cocoșilă M.* (2020) Simulation of operation of neural network with purpose of utilisation of hydraulic actuators in complicated technical conditions / *International Journal of Agricultural and Biological Engineeringthis link is disabled*, 2020, 13(1), стр. 11–19. (in Eng.)

Yashcheritsyn P.I., Borisenko A.V., Drivotin I.G. (1987) Rotary Material Cutting – Minsk, – pp. 229. (in Rus.).

Zubkov N.N. (2003) Multifunctional technology for increasing the surface area to improve the heat exchange and technological properties of parts // Flight (aviation, rocket technology and astronautics). No. 3. S. 41-46. (in Russian).

Zhunusbekova Zh.Zh, Kadyrov A.S. (2016) Study of digging machine flat element loading in clay solution / Journal "Naukovyi Visnyk Natsionalnoho Hirnychoho Universytetu" Volume №2 (152), P.30-33. (in Eng.).

CONTENTS

G.R. Baspakova, S.K.Alimkulov, E.S. Sarkynov, A.A. Tursunova, A.R. Zagidullina, A.A. Saparova, K.M. Kulebayev
IMPACT OF CLIMATE CHANGE AND ANTHROPOGENIC FACTORS ON THE RUNOFF OF THE ERTIS RIVER..6

K.A. Battakova, A.A. Saipov
THE INFLUENCE OF ATMOSPHERIC AIR POLLUTION ON THE GEOGRAPHY OF PROFESSIONAL HEALTH..23

Zh.G. Berdenov, R.Z. Safarov, E.Kh. Mendybaev, Zh.K. Shomanova, D.C. Ilies
IMPACT OF TECHNOGENIC FACTORS ON SURFACE WATER OF THE ILEK RIVER BASIN..37

M.T. Biletsky, B.T. Ratov, V.L. Khomenko, B.R. Borash, A.R. Borash
INCREASING THE MANGYSTAU PENINSULA UNDERGROUND WATER RESERVES UTILIZATION COEFFICIENT BY ESTABLISHING THE MOST EFFECTIVE METHOD OF DRILLING WATER SUPPLY WELLS...51

I.M. Dyussebayev, Zh. Issabekov, A.D. Tulegulov, D.S. Yergaliyev, N.A. Bazhaev, A.A.Kaipova
METHODOLOGICAL BASIS FOR THE APPLICATION OF WIND GENERATORS IN GEOLOGY...63

T. Ibrayev, M. Li, N. Bakbergenov, M. Narbayev, A. Batyrbayeva
CURRENT ISSUES OF WATER MANAGEMENT IN KAZAKHSTAN...79

I. Isa, L.T. Kurmangaziyeva, M.K. Urazgaliyeva, A.A. Kubasheva, A.G. Kassanova
DEVELOPMENT OF A MATHEMATICAL MODEL OF THE OIL RESERVOIR KENKIYAK FIELD ON THE BASIS OF ITS GEOLOGICAL MODELS..93

G.Zh. Kokymbaeva, R.N. Uteev, A.S. Mardanov, Zh.S. Murzagalieva, E.V. Yermekov
MODELING PVT PROPERTIES OF RESERVOIR FLUIDS WITHIN THE KARATON-SARKAMYS BLOCK BY THE EXAMPLE OF THE PRORVA GROUP OF FIELDS..109

M. Mirdadayev, A. Basmanov, N. Balgabayev, B. Amanbayeva, A. Duisenkhan
RESEARCH OF HYDROGEOLOGICAL CONDITIONS AND ENERGY PARAMETERS OF ZONAL IRRIGATED SOILS WHEN OPTIMIZING ENERGY-EFFICIENT RECLAMATION TECHNOLOGIES IN THE REPUBLIC OF KAZAKHSTAN...128

Ye.Zh. Murtazin, D.K. Adenova, S.R. Tazhiyev
ASSESSMENT OF THE POTENTIAL OF SELF-DISCHARGING HYDROGEOLOGICAL WELLS FOR SUSTAINABLE DEVELOPMENT OF RURAL AREAS OF ZHAMBYL REGION...143

K.N. Orazbayeva, Zh.Zh. Moldasheva, B.B. Orazbayev, Y.A. Ospanov, S.Sh. Iskakova
MODELING AND OPTIMIZATION OF OPERATING MODES OF OIL HEATING TUBE FURNACES...156

V. Padar, S. Kuzembayev, V. Berezyuk, M. Sikhimbayev, B. Absadykov
RECOVERY AND HARDENING OF WORN PARTS FROM STEEL 25L FOR GRINDING EQUIPMENT...176

B.R. Rakishev, M.M. Mataev, Z.S. Kenzhetaev, A.Kh. Shampikova
INNOVATIVE METHODS OF INTENSIFICATION IN SITU LEACHING OF URANIUM IN DEPOSITS WITH LOW FILTRATION CHARACTERISTICS OF ORES..188

A.K. Sambetbaeva, E.B. Kurmanbekova, S.T. Shaltabaeva, S.A. Ugryumov
EVALUATION OF PROTECTIVE PROPERTIES OF COATINGS OF FILLED COMPOSITIONS BY ELECTROCHEMICAL METHODS...207

V.G. Stepanets, V.L. Levin, K.S. Togizov, I.Yu. Silachyov, D.A. Zheltov
NEW DATA ON THE MINERALOGY OF SUPRA-SUBDUCTION OPHIOLITES OF THE TEKTURMAS MOUNTAINS (CENTRAL KAZAKHSTAN)..219

V. Solonenko, N. Makhmetova, M. Kvashnin, N. Ivanovtseva, V. Nikolaev
VIBRODIAGNOSTICS OF METAL RAIL STRANDS FOR DIFFERENT TYPES OF FASTENINGS..238

N. Tauova, M.S. Yessenamanova, K. Kozhakhmet, A.R. Kushakov, A. Kaliyeva
GEOLOGICAL STATE OF THE STRATIGRAPHIC COMPLEX OF THE TENGIZ DEPOSIT..249

D. Urmanova, B. Durmagambetov, John D. Humphrey, S. Zagranichniy
GEOLOGICAL AND HYDRODINAMIC MODELING OF AN OIL FIELD OF THE PRICASPIAN REGION OF THE REPUBLIC OF KAZAKHSTAN..266

A.S. Zhumagulov, M.T. Manzari, G.B. Kezembayeva, S.M. Nurmakova, D.B. Mukanov
TECTONIC EVOLUTION AND HYDROCARBON ACCUMULATION CONTROLLING CHARACTERISTICS OF THE SHU-SARYSU BASIN..289

K.T. Sherov, A.K. Rakishev, B.N. Absadykov, M.R. Sikhimbayev, A. Esirkepov
EXPERIMENTAL STUDY OF CHIP FORMATION DURING ROTARY-FRICTION TURNING OF PARTS TYPE OF ROTATION BODIES FROM VARIOUS MATERIALS..306

Publication Ethics and Publication Malpractice in the journals of the National Academy of Sciences of the Republic of Kazakhstan

For information on Ethics in publishing and Ethical guidelines for journal publication see http://www.elsevier.com/publishingethics and http://www.elsevier.com/journal-authors/ethics.

Submission of an article to the National Academy of Sciences of the Republic of Kazakhstan implies that the described work has not been published previously (except in the form of an abstract or as part of a published lecture or academic thesis or as an electronic preprint, see http://www.elsevier.com/postingpolicy), that it is not under consideration for publication elsewhere, that its publication is approved by all authors and tacitly or explicitly by the responsible authorities where the work was carried out, and that, if accepted, it will not be published elsewhere in the same form, in English or in any other language, including electronically without the written consent of the copyright-holder. In particular, translations into English of papers already published in another language are not accepted.

No other forms of scientific misconduct are allowed, such as plagiarism, falsification, fraudulent data, incorrect interpretation of other works, incorrect citations, etc. The National Academy of Sciences of the Republic of Kazakhstan follows the Code of Conduct of the Committee on Publication Ethics (COPE), and follows the COPE Flowcharts for Resolving Cases of Suspected Misconduct (http://publicationethics.org/files/u2/New_Code.pdf). To verify originality, your article may be checked by the Cross Check originality detection service http://www.elsevier.com/editors/plagdetect.

The authors are obliged to participate in peer review process and be ready to provide corrections, clarifications, retractions and apologies when needed. All authors of a paper should have significantly contributed to the research.

The reviewers should provide objective judgments and should point out relevant published works which are not yet cited. Reviewed articles should be treated confidentially. The reviewers will be chosen in such a way that there is no conflict of interests with respect to the research, the authors and/or the research funders.

The editors have complete responsibility and authority to reject or accept a paper, and they will only accept a paper when reasonably certain. They will preserve anonymity of reviewers and promote publication of corrections, clarifications, retractions and apologies when needed. The acceptance of a paper automatically implies the copyright transfer to the National Academy of Sciences of the Republic of Kazakhstan.

The Editorial Board of the National Academy of Sciences of the Republic of Kazakhstan will monitor and safeguard publishing ethics.

Правила оформления статьи для публикации в журнале смотреть на сайтах:
www:nauka-nanrk.kz
http://www.geolog-technical.kz/index.php/en/
ISSN 2518-170X (Online),
ISSN 2224-5278 (Print)

Директор отдела издания научных журналов НАН РК *А. Ботанқызы*
Заместитель директор отдела издания научных журналов НАН РК *Р. Жәлиқызы*
Редакторы: *М.С. Ахметова, Д.С. Аленов*
Верстка на компьютере *Г.Д.Жадыранова*

Подписано в печать 14.10.2022.
Формат 70х$90^1/_{16}$. Бумага офсетная. Печать – ризограф.
20,0 п.л. Тираж 300. Заказ 5.

Национальная академия наук РК
050010, Алматы, ул. Шевченко, 28, т. 272-13-19