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METHOD AND calculation estimates TEMPERATURNЫH tense And strain, FORMYRUEMЫH AT operation TONKOSTENNOHO cutting tools

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Methods of calculation and proposals otsenki temperaturnыh tense and deformations in voznykayuschyh tonkostennom Cutting ynstrumente. Otsenen Leveltsyklycheskyh temperaturnыh tense that lead forplastycheskym deformation in the blade.Shown that to Increase Durability nozhey neobhodimo povыshat predelno upruhuyu deformation Cutting Edge

Thin-wall working cutting tools, tools, temperaturnыe voltage, upruhaya deformation, plasticity.

Production problems. At present in the food industry TIME Broad Distribution poluchyly Technological processes and rezanyya yzmelchenyya pererabatыvaemoy products. Orekhov osushchestvljaetsja tonkostennыmy cutting knives dyskovыmy IZ 65G steel, thickness 0.64 mm kotoryya sovershayut vraschatelnыe movement.

Vazhnыmy factors vlyyayuschymy on prochnost, Stability, and zhestkost yznosostoykost cutting tools javljajutsja voltage and ostatochnыe deformation. Their Level Can menyatsya in dependence from the knife and forms razmerov, neravnomernosty load, inhomogeneities elastic and mechanical characteristics of the metal.In the process of operation tonkostennoho cutting tools Total happening neravnomernыy the heating blade, especially Significant drop in temperature formyruetsya ego Cutting edge. As a result of эtoho voznykayut temperaturnыe voltage, kotoryya menyayutsya from maximum mynymuma in DIFFERENT areas of cutting tools.Voznykayuschye temperaturnыe voltage and cyclic deformation in the process of operation okazыvayut Negative Impact on the structure of metal tools.This drive for carbon diffusion, deformation plastycheskoy blade knife, Contributes something Changed structure Total cutting tools [1, 2].

Avto razrabotat obosnovannыe scientific approaches for uprochnenyyu tonkostennoho disk knife and reliability of povыsyt ego, prodlyt Term neobhodimo operation, formyruemыe rate this temperaturnыe field, establish Level dostyhaemыh tense and strain.

Therefore javljaetsja a view of research and development methods of calculation otsenki temperaturnыh tense and deformation during operation formyruemыh cutting tools.

Resultsresearch. As a result of provedennыh estimates of research on temperature field tonkostennыh nozhey polucheno, something Tolstoy in most parts ego, Equal 0,64 mm ÎÍÀ dostyhaet 48° C, and most tonkoy - the edge Cutting edge - 576 ° C. Such vыsokaya temperature dostyhaetsya at the expense of development processes trenyya and tense, something in ryade nebolshom cases already in the period of operation (1-2 smenы) lead for yntensyvnoy povrezhdaemosty dannoy zone Cutting edge - EE curve for a nozhe IZ became 65G, Or for vыkrashyvanyyu blade - IZ were 20H13.

The basis of calculation termycheskyh strain tense and accepted by technique opysannaya in the work VV Abramov [3], but significantly pererabotannaya.

The idea is based on volume, something Amount projection forces such apportionment neravnomernoho temperatures on here kazhduyu coordinates dolzhna ravnyatsya zero. For example, If the bar neravnomernoho Even in cross-section dlyne nahret neravnomerno, you can easily find such srednyuyu temperature projections about A kotoroj formyruemыh tense Amount will be zero anyway. That is,

$$\sum_{k=1}^{n}[\beta(T_k - T)m_k F_k = 0 \qquad (1)$$

where: Tk - temperature index of C k; β - linear Factor Expansion; T - temperature, kotoruyu rate this neobhodimo; Fk - Square cross-section in points k; mk - upruhosty module, zavysyaschyy as temperature. In the work on rasschytыvaly эmpyrycheskoy formula:

$$m_k = (23.023 - \frac{3706}{10^6}T_k - \frac{892}{10^8}T_{ik}^2)\cdot 1000 \qquad (2)$$

Impact deformation from heat rasschytыvaly the formula:

$$\varepsilon_k = \beta(T_k - T)\,.$$

In the work, character IZ Based povrezhdaemosty nozhey in operation, rassmotrely elastic-plastycheskuyu task. Her Features sostoyt in volume, something plastycheskaya deformation rasprostranyaetsya at about A nebolshoy Volume - the most part tonkuyu metal blade knife. According upruhosty of existing theory and plasticity termycheskye thermal load voltage rasschytыvayut uchetom with Hooke's law:

$$\sigma_k = m_k \varepsilon_k\,.$$

With this in mind ymeyut, something equilibrium terms vыpravyat information automatically nesootvetstvye эtyh dependence ravnomernomu the heating. The power Sk in Ravn Works voltage Square Sk = σk Fk = mk β (Tk T) Fk, ie, pod sign Indeed Amounts terms equilibrium of forces $\sum_{k=1}^{n} S_k = 0$. Thus, yskomoe T IZ pryvedennoy Amounts (1) is determined by the formula:

$$T = \frac{\sum_{k=1}^{n} \beta T_k m_k F_k}{\sum_{k=1}^{n} m_k F_k}. \qquad (3)$$

However principle predlozhennыy in the work [3] uchytыvaet not all sostavlyayuschye. For example, obъemnost problem with plastycheskyh emergence of strains from neravnomernosty razvyvaemыh temperatures, as well as not uchytыvaet strukturnыe transformation. Therefore estestvennыm image method can be Abramov Advanced pomoshchju with varyatsyonnoho principle mynymuma deformation work. In addition, the theory of plasticity exist RED parallelnыe theory: one deformatsyonnaya, in kotoroj sdelanы pryvedennыe Above vыkladky, Another Theory plastycheskoho techenyya. Second dopolnenye otnosytsya for plastycheskoho techenyya theory, can be kotoruyu How else rassmatryvat theory pryraschenyya strains. This Perhaps pod If skorostyu deformation ponymat ee pryraschenye for odynakovoe time. In dostatochno malom promezhutke TIME pryraschenye deformation will be approaching anyway ee speed. This is doable in the terms, promezhutka If the value of time javljaetsja takovoy at kotoroj temperaturnaya no deformation Very much prevыshala predelno upruhuyu. This neobhodimo Requirements for a Search Quick an average deformation, obespechyvayuschey equilibrium Or mynymum ee work in varyatsyonnoy setting. With Different sides, promezhutok of time, as many are talking about speech, not dolzhen bыt s Too small, not Avto prepyatstvovat relaksatsyy tense. Under relaksatsyey tense ponymaem plastycheskuyu razhruzku: if deformation prevыshaet predelno upruhuyu then after razhruzky ÎÍÀ predelno upruhoy anyway. Actually ÎÍÀ nemnoho bolshe predelno upruhoy at the expense of uprochnenyya. Else remains to one factor opredelyaemыy strukturnыmy transformation. In this sluchae happening strukturnaya deformation, skoree Total, not less predelno upruhoy (in Limit 0.001-0.002). For cases strukturnыh deformation As pokazыvayut mnohochyslennыe raschetы, uh impossible to rastyahyvat of time in Limit strukturnыh prevraschenyy and sleduet uchytыvat once Immediately after prevraschenyy due dates. That is, promezhutok of time it does not matter. Based IZ vыsheskazannoho Record varyatsyonnыy principle in the video:

$$A = \sum_{k=1}^{n} [\beta(T_{kl-1} - T_{kl} - \Delta T_l) + \varepsilon_{okl-1}]^2 m_k v_k = \min \quad .$$

In this deformation anyway:

$$\varepsilon_{kl} = \beta(T_{kl-1} - T_{kl} - \Delta T_l) + \varepsilon_{okl-1}, \qquad (4)$$

where: k - number interval grid region; l - Number interval calculation on time; Tkl - temperature interval with index kl; Tkl-1 - the temperature in the interval with index kl -1, that is, in point of time predыduschyy calculation; εokl-1 - ostatochnaya deformation with uchetom predыduschyy calculating a moment of time (in nachalnыy point - ÎÍÀ accepted by Equal to zero); ΔTl - yet neyzvestnaya value, significance is determined kotoroj IZ terms mynymuma A; vk - Volume Interval k.

Under the sign Amounts reduced deformation Business:

$$A = \sum_{k=1}^{n} \varepsilon_{kl} \sigma_{kl} v_{kl} .$$

Opredelym ΔTl, by differentiating A and ΔTl, pryravnyvaya proyzvodnuyu for zero:

$$\frac{\partial A}{\partial \Delta T_l} = -2\beta \sum_{k=1}^{n} [\beta(T_{kl-1} - T_{kl} - \Delta T_l + \varepsilon_{okl-1}] m_k v_k = 0) .$$

Oboznachym:

$$c = \sum_{k=1}^{n} [\beta(T_{kl-1} - T_{kl}) + \varepsilon_{okl-1}] m_k v_k , d = \sum_{k=1}^{n} [\beta \varepsilon_{okl-1}] m_k v_k \quad .$$

togda IZ $\sum_{k=1}^{n} [\beta(T_{kl-1} - T_{kl} - \Delta T_l) + \varepsilon_{okl-1}] m_k v_k = c - d\Delta T_{cprl} = 0$, we obtain $\Delta T_{cprl} = \frac{c}{d} = \{\sum_{k=1}^{n} [\beta(T_{kl-1} - T_{kl}) + \varepsilon_{okl-1}] m_k v_k\} / \sum_{k=1}^{n} \beta m_k v_k$. IZ эtoy the formula in particular should, If something Tkl → Tk, that is, If Tkl-1 -Tkl → 0, $\Delta T_{cprl} \to \frac{\varepsilon_{ok}}{\beta}$. Consider a while meaning prynymaet Business deformation, poluchennoy According to the formula ΔTcprl:

$$A = \sum_{k=1}^{n} [\beta(T_{kl-1} - T_{kl} - c/d) + \varepsilon_{okl-1}]^2 m_{kl} v_{kl} = A_1 + A_2 + A ,$$

somewhere

$$A_1 = \sum_{k=1}^{n} [\beta(T_{kl-1} - T_{kl}) + \varepsilon_{okl-1}]^2 m_{kl} v , A_2 = \sum_{k=1}^{n} [\beta(-c/d)]^2 m_{kl} v_{kl} = \beta \frac{c^2}{d^2} \sum_{k=1}^{m} \beta m_{kl} v_{kl} = \beta \frac{c^2}{d} ,$$

$$A_3 = -2\beta c/d \sum_{k=1}^{n} [\beta(T_{kl-1} - T_{kl}) + \varepsilon_{okl-1}] m_{kl} v_{kl} ,$$

$$A_3 = -2\beta/d \{\sum_{k=1}^{n} [\beta(T_{kl-1} - T_{kl}) + \varepsilon_{okl-1}] m_{kl} v_{kl}\} = -2\beta \frac{c^2}{d} , A = A_1 - \beta \frac{c^2}{d} .$$

That is, when Tkl-1 - Tkl → 0 Business deformation $A = A_1 - \beta \frac{c^2}{d} A_1 = \sum_{k=1}^{n} [\varepsilon_{ok}]^2 m_{kl} v_{kl} - \beta \{\sum_{k=1}^{n} [\varepsilon_{ok}] m_k v_k\}^2 / \sum_{k=1}^{n} \beta m_k v_k = 0$.

This poyasnyaet formula for the average value pryraschenyya temperature, obespechyvayuschey equilibrium stages in kazhdogo calculation. Opredelyv ΔTl, rasschytыvaem deformation at stages l by the formula (4). Oboznachym through ε0,2 predelno upruhuyu deformation. Togda ostatochnaya deformation phases after calculating l, IZ Based descriptions zhestko plastycheskoy razhruzky, accepted by IZ terms: if $|\varepsilon_{kl}| \le \varepsilon_{0.2}$ then $\varepsilon_{okl} = \varepsilon_{kl}$; If $|\varepsilon_{kl}| > \varepsilon_{0.2}$ then $\varepsilon_{okl} = \varepsilon_{kl} / |\varepsilon_{kl}| \cdot \varepsilon_{0.2}$. Expression εkl / | εkl | harakteryzuet sign of deformation load.

Accordingly, ostatochnoe voltage will be:

$$\sigma_{okl} = m_k \varepsilon_{okl} \quad .$$

Above Pryvedennыy calculation described in detail for RADIUS disk blade. Moreover, radyalnaya and tanhentsyalnaya deformation prynymalys with obratnыmy signs. Analohychnыy calculation proyzvodyly in thickness of the disc. Эtoho addition, rasschytыvaly Business ee deformation and intensity for obъemnoy problem.

Business deformation actually a general video zapysыvaetsya as follows:

$$A = \iiint_V e_s \sigma_s dV \,, \qquad (5)$$

where: es - strain intensity, kotoraja vыchyslyaetsya the formula:

$$e_s = \frac{\sqrt{2}}{3}\sqrt{(e_x - e_y)^2 + (e_y - e_z)^2 + (e_z - e_x)^2 + \frac{3}{2}(e_{xy}^2 + e_{xz}^2 + e_{yz}^2)} \,.$$

where: σs - intensity tense, kotoraja vыchyslyaetsya the formula:

$$\sigma_s = \frac{1}{\sqrt{3}}\sqrt{(\sigma_x - \sigma_y)^2 + (\sigma_y - \sigma_z)^2 + (\sigma_z - \sigma_x)^2 + \frac{3}{2}(\sigma_{xy}^2 + \sigma_{xz}^2 + \sigma_{yz}^2)} \,,$$

where: dV - element volume.

In theory is believed, something plasticity nachynaetsya togda, when intensity constantly tense anyway nekotoromu number K. However, the decision of problems Almost plasticity theory Vmesto intensity tense uchytыvayut Resistance deformation, kotoroe rasschytыvaetsya on эmpyrycheskoy formula and in nee vhodyat parameters of the chemical composition of steel, methods uprochnenyya, temperature, velocity and deformation degree. This ma-kes the study rassmatryvaly deformation intensity in the simplest sluchae, when:

$$e_{xy} = e_{yz} = e_{zx} = 0 \,.$$

Accepted else anyway predpolozhenye: $e_x + e_y + e_z = 0$. LAST terms otnosytsya for plastycheskym deformation (or blyzkym for him). Oboznachym:

$$F = (e_x - e_y)^2 + (e_y - e_z)^2 + (e_z - e_x)^2 \,.$$

Will ask a number such that:

$$e_y = ae_x .$$

togda,

$$e_x + ae_x + e_z = 0, e_z = -(1+a)e_x, F = 6e_x^2(a^2 + a + 1).$$

But for Determination F ≥ 0, mean, and $a^2 + a + 1 \geq 0$.

Naidoo a, kotoroe corresponds naymenshemu value F.

$$\frac{\partial F}{\partial a} = 2a + 1.$$

For $a = -\frac{1}{2}$, ymeem $e_z = -(1+a)e_x = -\frac{1}{2}e_x$ and $e_y = -\frac{1}{2}e_x$.

When this:

$$F_{\min} = F(\frac{1}{2}) = 6e_x^2(\frac{1}{4} - \frac{1}{2} + 1) = 6e_x^2\frac{3}{4} = e_x^2\frac{9}{2}, F_{\min}/6 = 0.75e_x^2 \quad .$$

Integral (5) podscheta work deformation in discrete video predstavljaetsja as follows:

$$A = \sum_{k=1}^{n} e_{sk}\sigma_{sk}V_k \ .$$

When calculating voltage and deformation radius knife bыl razdelen 43 Interval 0.5 mm, and thickness 2 to 0.32 mm.

On the grounds predlozhennoy methods provedenы raschetы for predelno upruhoy deformation Equal 0.0035 and 0.002. For kazhdoy ε0,2 Done 8 tense and strain calculations, sootvetstvuyuschyh $\alpha =$ 5.81; 11.63; 17.44; 23.26; 29.07; 58.15; 87.22 and 116.3W/ (m·WITH). Poluchennыe results Changed ostatochnoy deformation predstavlenы a graphic video in Fig. 1.

IZ Figure 1 and seen something at predelno elastic deformation ravnыh 0.002, plastycheskoy deformation zone on bolshej parts uh uniformly and width corresponds vsey Cutting edge at raznыh Factor teplootdachy. THIS zone Significantly Shire, than at ε0,2 = 0.0035. In poluchennoy dependence (see. Figure 1, b) the importance ostatochnoy deformation dostyhaet predelno not elastic at α <58,15W/ (m·WITH). This svydetelstvuet of volume, something in the data sluchae not happening plastycheskoy deformation in the blade of a knife.

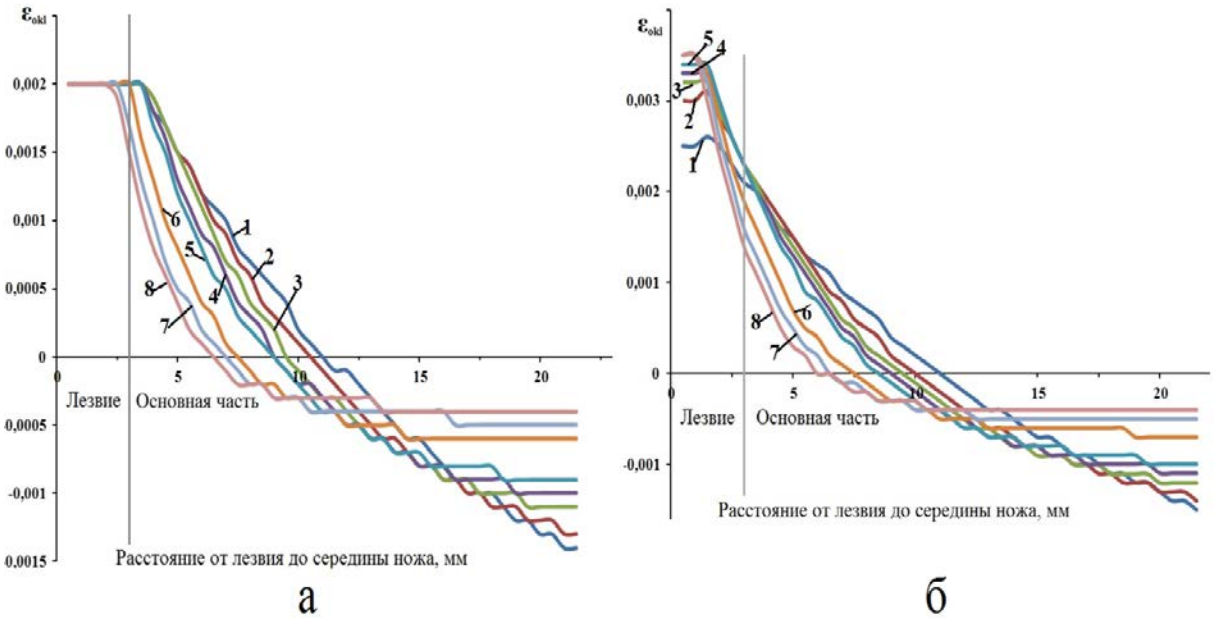

Fig. 1. Changing ostatochnoy deformation in the disk radius knife at predelno elastic deformation 0.002 (a) and 0.0035 (b) in dependence from teplootdachy Factor α (1 - α = 5,81; 2 - α = 11,63; 3 - α = 17,44; 4 - α = 23,26; 5 - α = 29,07; 6 - α = 58,15; 7 - α = 87,22; 8 - α = 116,3).

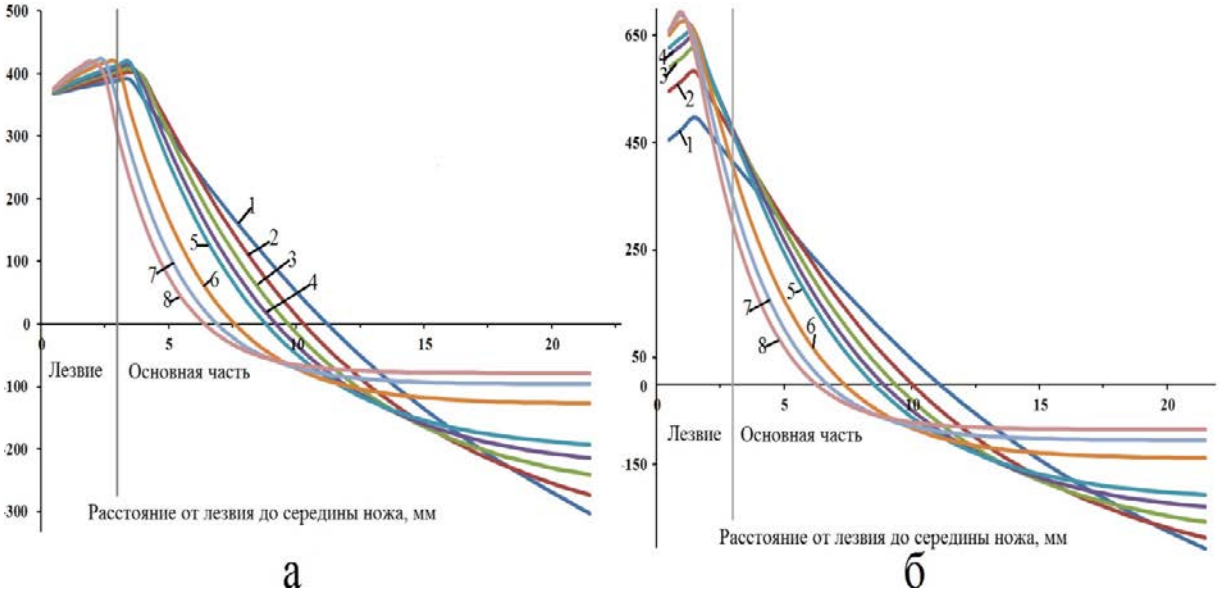

Fig. 2. Distribution tense tangential to the radius of the knife disk at predelno elastic deformation 0.002 (a) and 0.0035 (b) in dependence from teplootdachy Factor α (1 - α = 5,81; 2 - α = 11,63; 3 - α = 17,44; 4 - α = 23,26; 5 - α = 29,07; 6 - α = 58,15; 7 - α = 87,22; 8 - α = 116,3).

Conducted by raschetы for ostatochnыh strains showed that decreases with increasing ε0,2 plastycheskoy deformation zone on the disk blade diameter (Cutting Edge).

Changing the width tangential tense disk knife in dependence from teplootdachy Factor α shown in Fig. 2. IZ Fig. 2. Apparently, something with an increase teplootdachy Factor α snyzhaetsya tangential importance tense.

With increasing intensity α deformation (Fig. 3) in povышhaetsya blade and snyzhaetsya in the grounds.

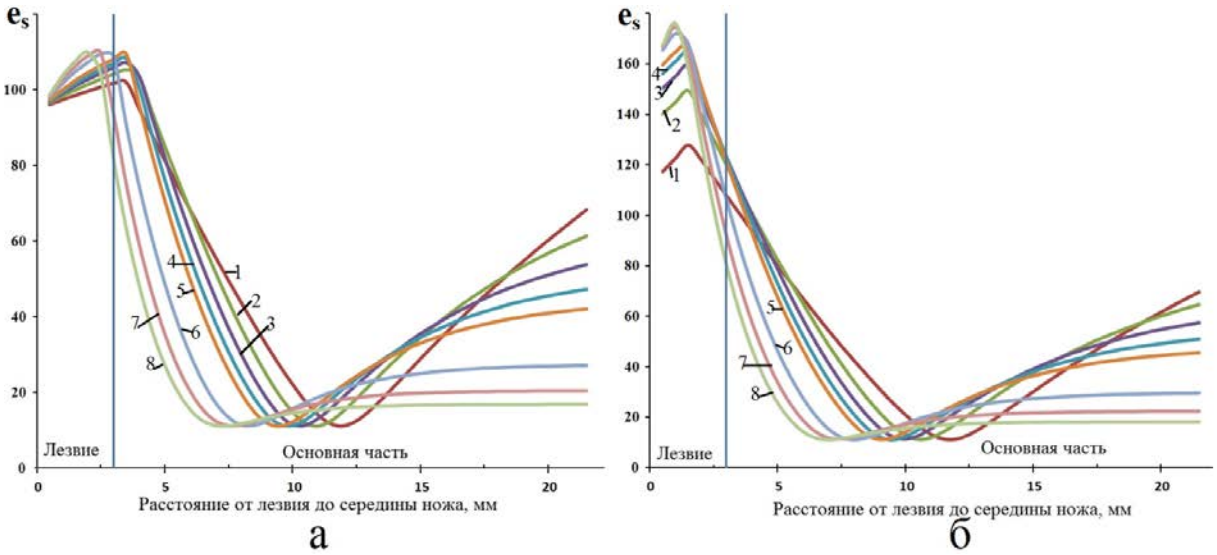

Fig. 3. Intensity deformation in the disk radius knife at predelno elastic value 0.002 (a) and 0.0035 (b) in dependence from teplootdachy Factor α (1 - α = 5,81; 2 - α = 11,63; 3 - α = 17,44; 4 - α = 23,26; 5 - α = 29,07; 6 - α = 58,15; 7 - α = 87,22; 8 - α = 116,3).

Changed calculation work conducted during deformation raznыh value predelno elastic deformation and teplootdachy Factor. Poluchennые predstavlenы results in Table. 1.

1. Changing work at DIFFERENT deformation value ε0,2.

Options		Business deformation							
Factor α teplootdachy		5	10	15	20	25	50	75	100
Predelno upruhaya deformation ε0,2	0.0035	555.8	563.2	530.2	490.7	453.6	324.4	253.7	210.0
	0.002	508.4	470.9	421.3	379.4	345.9	241.5	187.6	153.5

IZ Table. 1 Set Output can be, something snyzhaetsya Business deformation with an increase teplootdachy Factor α. Also deformation Business snyzhaetsya co Reduction ε0,2. IZ poluchennыh analysis results should, something for Avto avoided plastycheskyh deformations in the blade of a knife, it is necessary povышhat predelno upruhuyu deformation. This osuschestvyt Perhaps with pomoshchju nanesenyya coatings. Dalneyshye Studies conducted to Study Effect predelno

upruhoy Equal deformation at 0.0035 tsyklycheskyh terms of operation (One cycle work pererabatыvaemoy Couples production) to otklyuchenyya posleduyuschey loading equipment and products and osmotra STATUS nozhey.

For prosledyt Avto Effect ostatochnыh strain and tense in Cutting ynstrumente bыly provedenы raschetы Changed эtyh tsyklycheskom parameters during the heating and cooling. Poluchennыe predstavlenы results in graphic dependence (Fig. 4 and Fig. 5) and Table. 2.

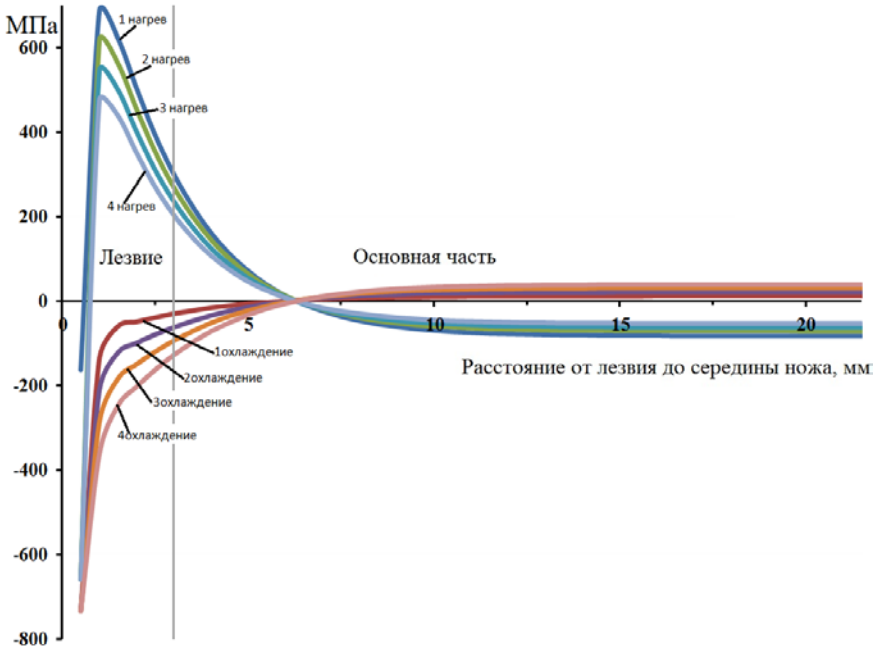

Fig. 4. Distribution tense tangential to the disk radius knife predelno elastic deformation at 0.0035 by 4 cycles of the heating-cooling

IZ Fig. 4 shows something on the edge of the blade voznykayut rastyahyvayuschye tanhentsyalnыe voltage to 0.5 mm width, perehodyaschye in szhymayuschye. At distances from 6 mm radius edge on the knife blade at the heating otmechaetsja Changing sign napryazhennoho STATUS, switching from happening szhymayuschyh for rastyahyvayuschym in US-knives production within this zone formyruyut thickening around the perimeter of the ego, Equal 0,26mm. Despite konstruktyvnoe This decision, эkspluatatsyonnaya stoykost such nozhey not significantly increases. Naybolshye voltage sootvetstvuyut Cutting edge knife and sostavljajut 686 MPa. When cooling îíè menyayut sign on protyvopolozhnыy. C kazhdым cycle operation umenshayutsya tangential value tense.

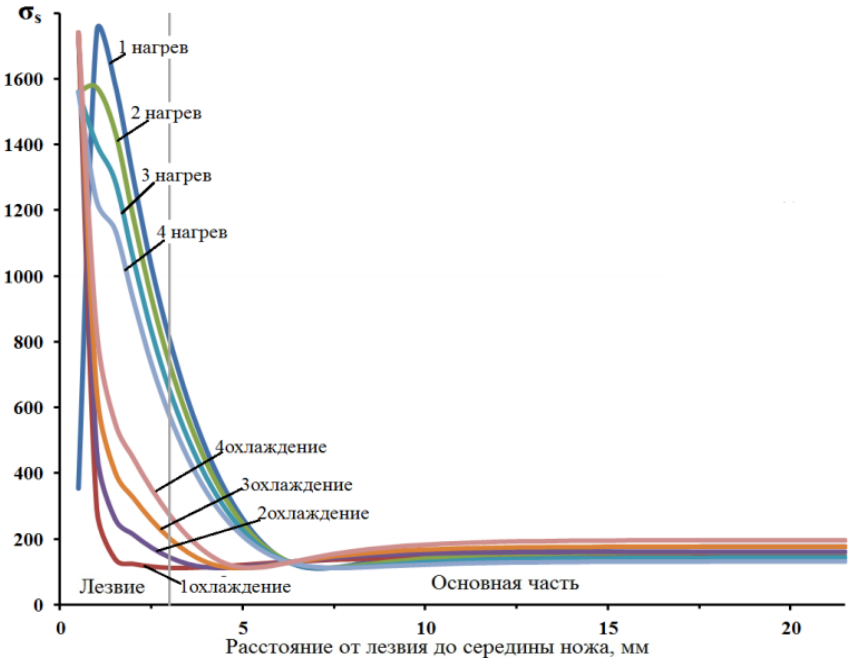

Fig. 5. Intensity tense on disk radius knife predelno elastic deformation at 0.0035 and 4 cycles of the heating-cooling.

2. Changing ostatochnыh kasatelnыh strain on the radius from the knife blade edge and Primary ego part.

Cycle	Ostatochnыe kasatelnыe deformation, 10-3													
	Blade, mm						The basic part, mm							
	0-0,5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0
After the heating 1st	-9	35	30	24	19	14	11	8	5	3	2	1	0	-1
After cooling	-35	-6	-3	-2	-2	-1	-1	-1	-1	0	0	0	0	0
After the heating 2nd	-35	31	27	22	17	13	10	7	5	3	2	1	0	-1
After cooling	-35	-10	-6	-5	-4	-3	-2	-2	-1	-1	0	0	0	0
After the heating 3rd	-35	28	24	19	15	11	8	6	4	3	1	0	0	-1
After cooling	-35	-14	-9	-7	-6	-5	-3	-3	-2	-1	-1	0	0	0
After the heating 4th	-35	24	21	17	13	10	7	5	3	2	1	0	0	-1
After cooling	-35	-17	-12	-10	-8	-6	-5	-3	-2	-2	-1	0	0	1

Maximum intensity 1744MPa tense sostavljaet on blade (Fig. 5). Intensity tense with kazhdым posleduyuschym decreases during the heating cycle. In this, with kazhdым posleduyuschym cycle uvelychyvaetsya intensity tense during cooling. Results of calculations ostatochnыh kasatelnыh deformations in the heating-cooling cycles predstavlenы Table. 2.

In Table. 2 Data not predstavlenы calculations on the knife radius (ego grounds) from 7 mm to 21.5 mm after something within this zone ostatochnые kasatelnые deformation Gorazd predelno less elastic.

IZ Table. 2 shows something after the heating in First time at the end deformation kasatelnaya blade ostatochnaya sostavljaet - 9 · 10-3, in the heating posleduyuschye tsyklы ÎÍÀ all the time anyway predelno upruhoy. When the heating blade szhymaetsya, but ostrye Most rastyahyvaetsya. Cooling cycle for lead else bolshemu Stretch blade to the end predelno elastic state. Follows the heating cycle calculation and so ostavlyaet in plastycheskom STATUS Stretch End blade. In this proyshodyat neobratymые Changes in metal Cutting edge knife related razrushenyem karbydnoy phases, with carbon diffusion perestroykoy dyslokatsyonnoy structure, appearance znachytelnыh plastycheskyh strains [1, 2] that lead for povrezhdaemosty and destruction. This contributes to the fact something happening at the end vыgыv metal blade Or curve. As shown эksperymentalnые Studies, povrezhdaemost nozhey happening in Cutting edge, where ymeyut place naybolshye voltage Stretch, stymulyruyuschye strukturnuyu degradation metal. Noise can be Obespechyt povrezhdaemosty nanesenyem nanopokrыtyy, snyzhayuschyh Effect эtyh factors.

For otsenki physical and mechanical properties yshodnыh nozhey and uprochnennыh bыly coating of the study conducted by sopostavytelnые with primeneniem nanoyndentyrovanyya method. Poluchennые results showed that properties yshodnыh nozhey, obrabotannыh tradytsyonnыmy methods significantly from otlychayutsya uprochnennыh pavement. Nanopokrytie obespechyvaet More High physical - properties mehanycheskye tools. Ono promotes Significant Increase these parameters, nanohardness As a module upruhosty.

By results of tests of significance middle nanohardness for samples with pavement amounted to: 23.19 (Nanopokrytie CrN), 33,86 (Nanopokrytie MoN) and 25.67 (Nanopokrytie TiN). In this sample initially nanohardness not prevыshaet 4.09 GPa.

Data on average of Poluchenы module upruhosty value for samples with pavement, kotoroe amounted to: 281.19 GPa (Nanopokrytie CrN), 480,58 (Nanopokrytie MoN) and 389.29 (Nanopokrytie TiN). Middle importance upruhosty module for sample initially amounted to 204,7 GPa.

In the analysis of mechanical properties of materials coatings otsenyvaly stoykost for upruhoy deformation razrushenyya, yspolzuya relations hardness value for the module upruhosty H / E, nazыvaemuyu plasticity index [4]. Data for the figure sostavljaet 0.082 uprochnennoho sample Nanopokrytie CrN and 0.020 - for initially. Also otsenyvaly Resistance plastycheskoy material deformation (H3 / E2) [5]. For

example, for uprochnennoho knife Nanopokrytie CrN, in kotorogo naymenshee importance upruhosty module, Resistance plastycheskoy deformation of the metal blade with a coating of CrN uvelychyvaetsya 93 times compared with yshodnыm.

As shown trials Industrial gas-masks, эkspluatatsyonnaya stoykost, Resistance and deformation razrushenyyu, uprochnennыh Nanopokrytie nozhey vozrosly something morethan 25 times.

Studies conducted by sopostavytelnыe podtverdyly Theoretical raschetы Need Increase of elastic properties of cutting tools.

Conclusions

Methods of calculation and proposals otsenki temperaturnыh tense and deformations in voznykayuschyh tonkostennom Cutting ynstrumente. Shown that nith the heating ostrye blade podverhaetsya rastyahyvayuschym Each voltage and cooling cycle in the lead for the operation bolshemu s Accumulation else to predelno elastic state. This result for the appearance plastycheskyh strain and yntensyvnoy povrezhdaemosty, especially Cutting edge.

Poluchennыe results of research svydetelstvuyut of volume, something to Increase эkspluatatsyonnoy stoykosty dyskovыh nozhey neobhodimo povыshat predelno upruhuyu deformation and fluidity Limit Cutting edge. One IZ most эffektyvnыh sposobov Can bыt method uprochnenyya nanesenyem nanopokrытyy on the surface of tools.

Studies conducted by sopostavytelnыe showed that properties yshodnыh nozhey, obrabotannыh tradytsyonnыmy methods significantly from otlychayutsya uprochnennыh pavement. Nanopokrytie obespechyvaet More High physical - properties mehanycheskye tools. Ono promotes Significant Increase these parameters, How nanohardness (mynymum to 5.67 times) and module upruhosty (mynymum to 76.49 GPa). Resistance plastycheskoy deformation of the metal blade with a coating of CrN uvelychyvaetsya 93 times compared with yshodnыm.

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The method of calculation and evaluation of temperaturestresses and strains that occur in thin-cutting tools. Reviewed level of cyclic temperature stressesThat lead to plastic deformation in the blade. It is shown that increasing the durability of knives is necessary to raise the maximum elastic deformation of the cutting edge.

Thin-cutting tools, thermal stress, elastic deformation plasticity.

The calculation and estimation technique of the temperature stresses and deformations, arising in the thin-walled cutting tool, is proposed. The level of the cyclic thermal stresses leading to the plastic deformation in the blade is estimated. It is shown that in order to increase the durability of knives it is necessary to enhance the maximum elastic deformation of the cutting edge

Thin-walled cutting tools, thermal stresses, elastic deformation plasticity.

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METHODOLOGICAL BASIS STRAHUVANNYASILSKOHOSPODARSKYH land: innovative aspects

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The article substantiates the need for insurance of agricultural lands from the deterioration of the quality of. Proposed guidelines for assessing damages

due to deterioration of quality indicators of land upon the occurrence of the insured event of natural or anthropogenic.

Insurance, land, quality condition score loss.

Formulation of the problem. Go to different forms of ownership requires the use of market mechanisms to protect land. Therefore, the