OPŠTI PODACI O TOCILIMA I BRUŠENJU

BRUŠENJE

Pod brušenjem se podrazumeva postupak oblikova-nja, skidanjem strugotina, pri čemu se sa brušenog predmeta, pomoæu brojnih, relativno malih šiljastih abraznih zrna sa oštrim ivicama skida strugotina. Prilikom brušenja abrazivna zrna se habaju na radnoj površini tocila. Dužim radom, sile koje dejstvuju na abrazivno zrno porastu, tako da se ona delimično ili potpuno odvajaju iz veze, međutim iza izlomljenih abrazivnih zrna se nalaze netaknuta oštra zrna, tako da se radna površina tocila stalno regeneriše. Ovo se često naziva abrazivnom tehnologijom i obično u pogledu na cilj koji možemo postiæi možemo je podeliti u tri osnovne grupe:

- održavanje geometrije oblika
- površinska obrada
- razdvajanje materijala.

Rad brušenja i istovremenog habanja se može svesti na tri principijelna uzroka:

1. Habanje abrazivnih zrna usled trenja
2. Mehanički lom abrazivnih zrna (delimično)
3. Uništenje sastava vezivnog sredstva.

BRUSNI ALATI

Brusni alati su pravilna geometrijska tela i predstavljaju aglomerat abrazivnog zrna i veziva koje povezuje abrazivna zrna u jednu celinu sa porama. Abrazivna zrna su uglavnom nepravilnog oblika, po svom obimu poseduju veæi broj oštrih reznih ivica koja u kontaktu sa materijalom koji se obradjuje skidaju strugotine. U rezanju učestvuje istovremeno veæi broj zrna, te se uzima da je tocilo rezni alat sa više sečiva.

Brusni alati po načinu rada mogu biti:

- ROTIRAJUĆI (ravna, razni oblici, sa drškom itd.)
- NEROTIRAJUĆI (segmenti, turpije, honinzi)

ABRAZIVNI MATERIJALI

Abrazivni materijali su tvrda tela koja posle usitnjavanja imaju zrnasti oblik. Služe da na drugim telima-materijalima, putem neposrednog pritiska i trenja izvrše obradu istih. Tom prilikom se i sami troše. Kao abrazivna sredstva se danas uglavnom koriste veštački materijali, a samo mali udeo imaju prirodni materijali.

Od veštačkih abraziva se u klasičnim tocilima koriste korundi i silicijumkarbidi.

GENERAL PARTICULAR ON GRINDING AND WHEELS

THE GRINDING

Under the grinding is meant the action of the forming with taking off the shavings, while from the grinding object, with the numerous, relative small pointed abrasive grains, with their sharp sides is taken off the shavings. While grinding, the abrasive grains wear out on the whetstone s active area. During the longer work, the powers, which act on the abrasive grains, will increases, to they partly or total separate from the connection, however behind the smashed abrasive grains are the untouched sharp grains, so the whetstone s active area always regenerates. it often calls the abrasive technology and usually in respect to the aim which we can reach, we can separate it in three basic groups:

- keping the geometry shape
- the surface treatment
- the material separating

The work of grinding and simultaneous wearing out can settle in three principle cause:

1. The abrasive grains wear out because of the friction
2. The mechanic trash of the abrasive grains (partly)
3. The structure of the connective tissue s means ruins.

THE GRINDING TOOLS

The grinding tools are the regular geometry bodies and they present the abrasive grain s agglomeration, the connective tissues which connect the abrasive grains in one totality and pore. The abrasive grains have mostly the irregular shapes, according to their volumes they own the numerous sharp carving sides which in connection with the material, which is making, take off the shavings. In carving, simultaneous take part the numerous grains, so it takes that the whetstone is the carving tools with the more blades. The grinding tools according to the wayof work can be:

- ROTATING (flat, the different shapes, mounted wheels etc.)
- NO ROTATING (the segments, the files, the hones).

THE ABRASIVE MATERIALS

The abrasive materials are the hard bodies, which after chopping up, have the granular shapes. They serve, by the immediate pressure and the friction, to perform the other bodies - materials. By this occasion they expend themselves. Today, as the abrasive means mostly use the artificial materials, and only the smaller pieces have the natural materials.

From the artificial abrasive materials are used the corundums and the silicon carbides in the classic whetstones.

Korundi

Po hemijskom sastavu je Al_2O_3, sa manje ili više primesa drugih oksida. Razlikujemo ga u više varijanti, počevši od najjednostavnijeg normal-korunda, preko poluplemenitog, pa do plemenitog korunda.
U zavisnosti od legirajuæih elemenata postoji takozvani roza, rubin i cirkon korund. Posebnu vrstu čini monokristalni korund.
Glavne karakteristike korunda su:
- mikrotvrdoæa od 16000 do 22000 N/mm^2
- termička postojanost do 1800^o C
- velika tvrdoæa i kod dinamičkih opterećenja
- sadržaj Al_2O_3 od 94 do 99,8%

The Corundums

According to its chemical structure it is Al_2O_3, with less or more ingredients of the other oxides. We differentiate it in more variants, starting from the easiest normal-corundum, through semiregular, so to the noble corundum.
In the dependence from the alloying elements, there are so-called pink, ruby and cirkon corundum.
The main features of the corundums are:
- the microhardness from 16000 to 22000 N/mm^2
- the thermal stability to 1800^o C
- the big hardness and also by the dynamic loand
- the contents Al_2O_3, from 94 to 99,8%

Silicijum-karbidi

Ovaj abrazivni materijal je jedan od najtvrdjih karbida. Po hemijskom sastavu je SiC. Razlikujemo ga u dve osnovne vrste i to: zeleni SiC, koji je tvrdji, i crni SiC, koji je žilaviji.
Glavne karakteristike:
- mikrotvrdoæa od 26000 do 30000 N/mm^2
- termička postojanost do 1400^o C
- vrlo krta i oštra zrna

The Silicon-Carbides

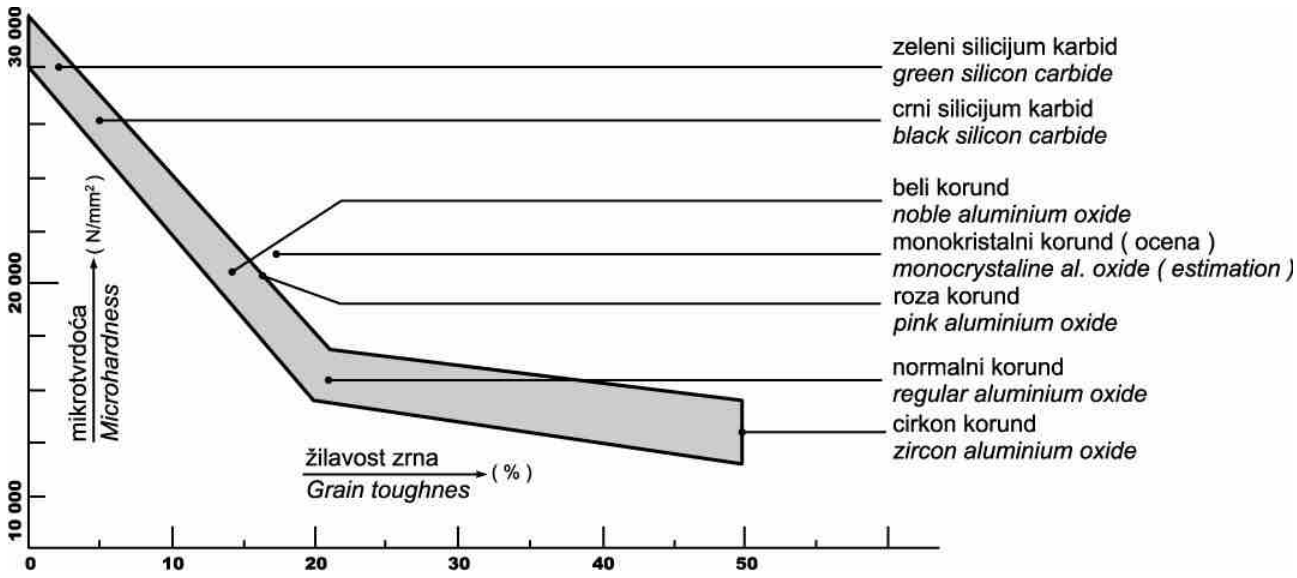
This abrasive material is one of the hardest carbides. According to its chemical structure it is SiC. We differentiate it in two basic sorts and they are: the green one SiC, which is harder and the black one SiC, which is more tough.
The main features:
- the microhardness from 26000 to 30000 N/mm^2
- the thermal stability to 1400^{o}C
- the very brittle and sharp grains

TVRDOĆA I ŽILAVOST ABRAZIVNIH ZRNA

Ove dve osobine abrazivnih zrna su u obrnutoj srazmeri, odnosno što je veæa mikrotvrdoæa, manja je žilavost i obrnuto.

THE HARDNESS AND THE TOUGHNESS OF THE ABRASIVE GRAINS

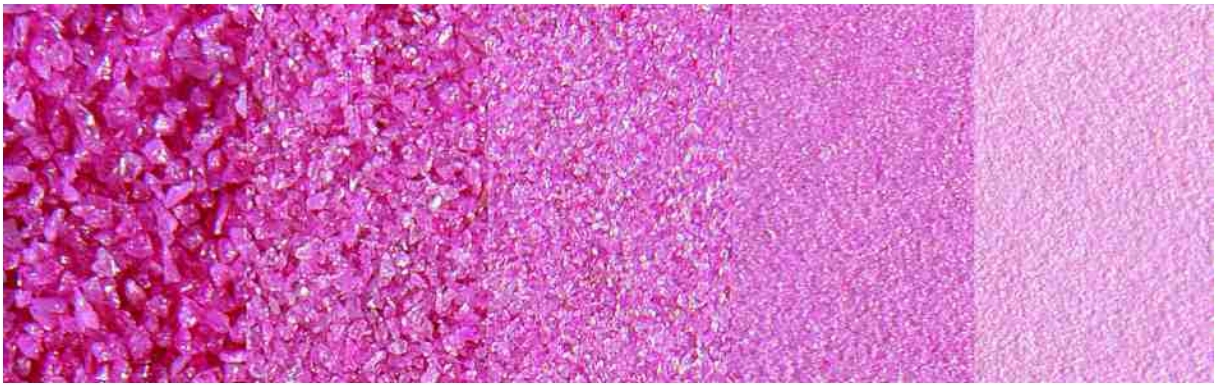
These two features of the abrasive grains are in the opposite relation, that is, as the microhardness is bigger, the toughness is smaller and opposite.



Specifična površina abrazivnih zrna

Specific Surface of Abrasive Grains

Nº ZRNA *Nº OF GRAIN*	PREČNIK ZRNA U mm *DIAMETER OF GRAIN mm*	SPEC. POVRŠINA ZA KORUND cm^2/g *SPEC. SURFACE FOR KORUND cm^2/g*	SPEC. POVRŠINA ZA SiC cm^2/g *SPEC. SURFACE FOR SiC cm^2/g*
6	3360	6,8	8,3
8	2380	9,7	11,3
10	2000	11,5	14,0
12	1680	13,7	16,6
14	1410	16,3	19,9
16	1190	19,3	23,5
20	1000	23,0	28,0
24	710	32,4	39,4
30	590	39,0	47,4
36	500	46,0	56,0
40	420	54,8	66,6
46	350	66,0	80,0
54	297	78,0	94,0
60	250	92,0	112,0
70	210	109,0	133,0
80	177	130,0	162,0
90	149	154,0	188,0
100	125	184,0	224,0
120	105	219,0	266,0
150	88	261,0	318,0
180	74	311,0	378,0
220	53	434,0	527,0
240	44	522,0	635,0
280	37	622,0	755,0



GRANULACIJA

Veličina abrazivnih zrna je definisana internacionalnim FEPA standardom i označava se brojevima. Broj pokazuje koliko otvora ima na situ kroz koje dotično zrno prolazi na dužini od jednog col-a. Na osnovu ovoga možemo ustanoviti da što je manji broj oznake to je zrno veæih dimenzije i obrnuto.

THE GRANULATION

The abrasive grains size is definated by the international FEPA standard and marked by the numbers. The number show how much openings are on the sifter, through which the concerned grain goes, in the length of one inch. According to this, we can establish, as the sign s number is smaller that the grain has the bigger dimension and opposite.

SKRAĆENA OZNAKA GRANULACIJE **F 10 do F 1200** ***THE REDUCING GRANULATION'S SIGNS*** ***F 10 to F 1200***	**SREDNJA OZNAKA ZRNA ds50** ***THE MIDDLE GRAIN'S SIGN ds50***
F.....10	2030
F.....12	1705
F.....14	1435
F.....16	1205
F.....20	1015
F.....24	720
F.....30	605
F.....36	510
F.....46	360
F.....54	300
F.....60	255
F.....80	180
F.....100	130
F.....120	110
F.....150	85
F.....180	70
F.....220	60
F.....240	44,5
F.....280	36,5
F.....320	49
F.....360	40
F.....400	32
F.....500	25
F..... 600	19
F.....800	14
F....1000	10
F....1200	7

VEZIVA

Veziva služe za povezivanje abrazivnih zrna u jednu celinu, odnosno u tocilo. Vrste veziva određuju i osnovnu tehnologiju izrade. Vrsta i količina veziva određuju čvrstoæu i tvrdoæu tocila, odnosno sposobnost brušenja.
"IBA" u svom proizvodnom programu izradjuje tocila u

THE BONDING MATERIAL

The BOND connect the abrasive grains in one totality, that is in the whetstone. The whetstone s sorts determine the basic technology manufacturing. The whetstone s sort and quantity determine the whetstone s strength and hardness, that is the grinding capability. "IBA" in its production program makes the whetstones in ceramics and resinoid, that is, in bakelite bond,

keramičkom i smolnom, odnosno bakelitnom vezivu.

Keramičko vezivo

Ova veziva su na bazi feldspata, raznih glina, kaolina i drugih neorganskih materija. Termička obrada tocila sa keramičkom vezom se vrši na temperaturama od 1200-1320º C. Ova tocila nisu osetljiva na hemijske uticaje i mogu se lagerovati neograničeno dugo.

Smolno vezivo

Koristi se bakelitna smola koja je po svom hemijskom sastavu fenolformaldehidna smola. Ovo vezivo daje tocilu odlična mehanička svojstva. Pogodno je za armiranje, sa staklenim pletivom ili drugim vrstama armature. U poredjenju sa keramičkim vezivom manje je osetljivo na nagle promene temperature i udarce, ali je osetljivije na hemijske uticaje i duže skladištenje.

Magnezitno vezivo

Ovo vezivo je na bazi kaustičnog magnezita i magnezijum hlorida. Tako nastala veza bez termičke obrade je tzv. hladna veza.
Veštački brusevi sa magnezitnom vezom su namenjeni za grubo i fino brušenje metala i nemetala. Kvalitet bruseva zavisi od vrste i veličine brusnog zrna i od tvrdoæe brusa.
Brus ne podnosi veliko statičko i dinamičko optereæenje. Prilikom transporta treba paziti da se brus mehanički ne ošteæuje.
Magnezitni brusevi su higroskopni, osetljivi na mraz, zato moraju skladištiti u suvim i zagrejanim prostorijama. Temperatura skladišnog prostora treba da bude na cca. 20º C a relativna vlažnost cca. 50%. Pod i zidovi koji su u blizini bruseva, moraju biti izolirani od vlage.
Tokom brušenja za hlaðenje obično se koristi voda ili neko drugo sredstvo za hlaðenje
Magnezitni brusevi se koriste pri malim brzinama do 25 m/s

STRUKTURA TOCILA

Struktura tocila je jedan empirijski broj, koji nam jednoznačno odredjuje količinu abrazivnog zrna u jedinici zapremine tocila.

and in magnesit bond.

The ceramics bond

These BOND base on the feldspar, the different clays, the kaolins and the inorganic materials. The whetstone s thermal making with the ceramics BOND acts on the temperature from 1200-1320º C. These whetstones are not sensitive on the chemical influences and they can have unlimited long stock.

The resinoid bond

The bakelite resin is used, which according to its chemical structure is the phenolformaldehide resin. This BOND gives to the whetstone the excellent features. it is suitable for making the metal framework, with the glass thatched or the other sort of the metal framework, with the glass thatched or the other sorts of the metal framework. In the comparison with the ceramics BOND, it is less sensitive to the sudden temperatures changes and the kickings, but it is more sensitive to the chemical influences and the longer stock.

Magnesite binding

This is a binding on the basis of caustic magnesite and magnesium - chloride. Such binding without thermic treatment is the so called cold binding.
Artificial grinding tools with magnesite binding are intended for rough and fine grinding of metals and nonmetals the quality of grinding tools depends from the type and size of the abrasive grain and from the hardness of the grinding tool.
The grinding tool does not stand big static and dynamic load prevent mechanical damages of the grinding tool during transportation.
Magnesite grinding tools are hydroscops, i.e., they are sensitive to frost, thus they must be stored in dry and heated premises. The temperature of the storage premises must be around 20 C◦, where as the relative humidity around 50%. The floor and the walls close to grinding tools must be isolated from humidity.
During grinding usually water or some other coolant is used.
Magnesite grinding tools are used at small working speeds up to 25 m/sec.

THE WHETSTONE S STRUCTURE

The whetstone s structure is one empirical number, which mono important determines the abrasive grain s quantity in the unit of the whetstone s volume.
The whetstones of the more closed structures contain the

Tocila zatvorenije strukture sadrže veæi procenat abrazivnog zrna po jedinici zapremine, u odnosu na tocila sa otvorenijom strukturom.
Strukture se obeležavaju brojevima od 0-14. Strukturni brojevi preko 10 označavaju visoko porozno tocilo. Kod ovih tocila je poroznost veštački poveæana specijalnim dodacima.

bigger percentage of the abrasive grains pro the volume s unit, in comparison with the more open whetstone s structure. The structures mark with the numbers from 0-14. The structure s numbers over 10 note the high porous whetstone. At these whetstones the porousness of the artificial is increased by the special additions.

TVRDOĆA TOCILA

Tvrdoæa tocila se manifestuje kao otpor koji pružaju vezana abrazivna zrna protiv ispadanja iz vezivnih mostova. Označavanje tvrdoæe se vrši po takozvanoj Nortonovoj skali slovima abecede. Što je slovna oznaka bliže početku abecede, imamo mekše bruseve, a što je bliže kraju abecede, imamo tvrdje bruseve.
Optimalnu tvrdoæu ima ono tocilo kod kojega abrazivno zrno ispada iz vezivnog mosta u momentu kada je postalo nepogodno za izvršavanje svoje osnovne funkcije, brušenja.
Najveæi uticaj na tvrdoæu ima udeo veziva, granulacija abrazivnih zrna i poroznost.
Merenje tvrdoæe tocila se u "IBA" ADA vrši sa tri različita uredjaja i to:
- merenjem E modul-a "Grindosonic-aparatom"
- peskarenjem "Mackensen"
- utiskivanjem kuglice "Rockwel"

THE WHETSTONE S HARDNESS

The whetstones hardness is manifested liker the resistance which the abrasive grains offer to the connections against the elimination from the connective bridges. The hardness note is performed by socalled
Norton s scale, using the alphabet s letters. As the letter s mark is nearer to the alphabet s beginning, we have the softer grindings, and so it is nearer to the alphabet s end, we have harder grindings.
The optimal hardness has that whetstone at which the
abrasive grain falls out from the connective bridge at the moment, when it is not suitable to do its basic function, the grinding.
The biggest influence on the hardness have the connective tissue s part, the abrasive grains s granulation and the porousness.
The whetstones s hardness measuring are done in "IBA" in Ada by three different machines and they are:
- by measuring the E- module "The Grindosonic"
- by sanding "The Mackensen s"
- by impressing the balls "The Rockwel".