NS TOOL

For Crafting Tomorrow

Micro Edge End Mill for Ultra Micro Manufacturing Vol.2

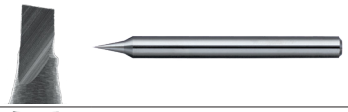
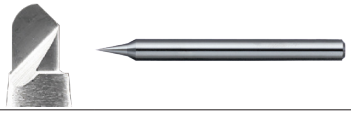
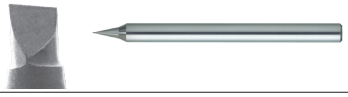
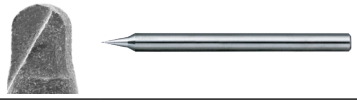
SMEZ120 SMB120 SMB200
NSME100 NSME230 NSMB100

Ultra micro × High precision

Features

Feature 1	Ultra Micro	Standard lineup from outer diameter 0.01mm

Microedge is a standard line-up end mill with an outer diameter of ϕ 0.1 or less in stock. As a leading company of small-diameter end mills, we have a wide variety of lineups that enable ultra-fine machining of various work materials such as high hardened steel, carbon steel, stainless steel, and aluminium alloys.

Material	Cutting edge design	Model	View	Size	Number of flute	Slot	Face	3D
Cemented carbide	Square	NSME100		φ 0.01 ~ φ 0.05	1	Slot	Face	-
Cemented carbide	Square	NSME230		φ 0.03 ~ φ 0.09	2	Slot	Face	-
Cemented carbide	Ball	NSMB100		R0.005 ~ R0.05	1	-	-	3D
CBN	Square	SMEZ120		φ 0.03 ~ φ 0.1	1	Slot	Face	-
CBN	Ball	SMB120		R0.01 ~ R0.05	1	-	-	3D
CBN	Ball	SMB200		R0.01 ~ R0.05	2	-	-	3D

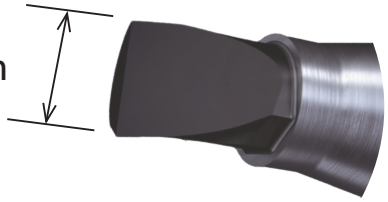
Feature 2

Ultra High Precision

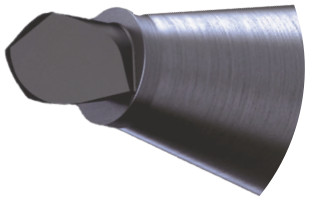
Tolerance ±0.002 mm

To enable micro precision machining, we keep outer diameter tolerance and runout accuracy are all within ± 0.002mm, shank accuracy is -0.001mm to -0.003mm for SMB200, and 0 to -0.0025mm for other micro edge products(JIS h3), to realize micro precision specifications.

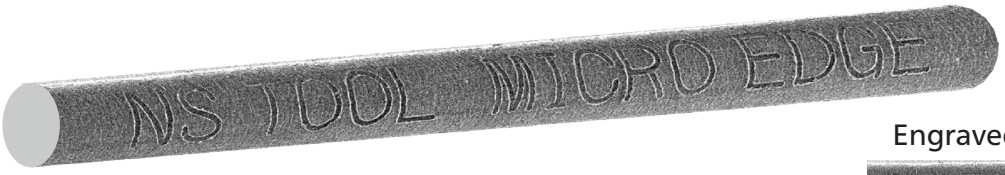
Outer Dia.
D± 0.002 mm



Radius
R±0.002 mm



Ultra micro end mill enables character engraving on hair



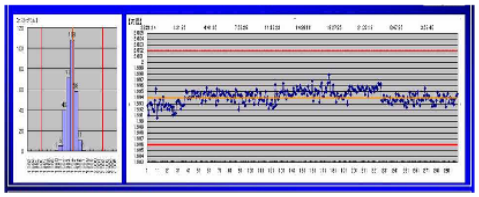
Engraved by NSME100 ϕ 0.01mm

Micro Edge is NS TOOL's flagship. R&D center, in house-development tool grinding machine "TGM", automatic inspection equipment, and factory employees. In order to pursue high-precision and stable quality and develop it into products, NS TOOL strives for zero tolerance every day. We continue to challenge ourselves tirelessly.

Sendai Plant

In-house development tool grinding machine TGM

New R&D Center



Stable process capability

SMEZ120

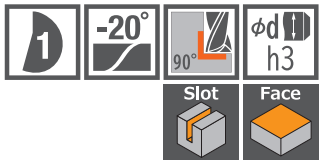
Size ϕ 0.03 ~ ϕ 0.1

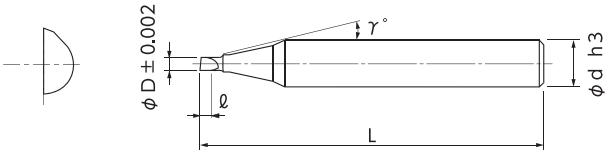
CBN ≦70 HRC

CBN "MICRO EDGE Z"

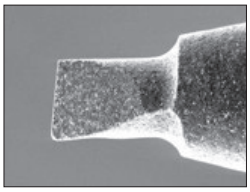
Total 8 sizes

CBN micro end mill with standardized of Dia.0.1mm or smaller





- NS TOOL engineering technology and selected CBN material realize sharp edge.
- Tolerance of flute diameter is ±2μm.
- Tolerance of shank diameter is h3 (0 ~ -0.0025).



Cutting edge shape

Work Material

Prehardened Steel P	Hardened Steel H		
	~55HRC	~65HRC	~70HRC
○	◎	◎	○

Unit [Size : mm]

Code No.	Dia. (D)	Length of Cut (ℓ)	Neck Taper Angle (γ)	Shank Dia. (d)	Overall Length (L)
01-00480-00030	0.03	0.03	15°	4	50
01-00480-00040	0.04	0.04	15°	4	50
01-00480-00050	0.05	0.05	15°	4	50
01-00480-00060	0.06	0.06	15°	4	50
01-00480-00070	0.07	0.07	15°	4	50
01-00480-00080	0.08	0.08	15°	4	50
01-00480-00090	0.09	0.09	15°	4	50
01-00480-00100	0.1	0.1	15°	4	50

How to Order When you order, indicate SMEZ120 (D). ※(γ) is reference value.

Recommended Milling Conditions

Work Material	Prehardened Steels・Hardened Steels NAK・STAVAX・SKD11・PD613 (~62HRC)			
Dia.	Depth of Cut		Feed	Spindle Speed
	ap mm	ae mm	mm/min	min^{-1}
0.03	0.0005	0.003	10	60,000
0.04	0.001	0.003	20	60,000
0.05	0.001	0.005	30	60,000
0.06	0.002	0.005	40	60,000
0.07	0.002	0.01	50	60,000
0.08	0.003	0.015	65	60,000
0.09	0.003	0.02	80	60,000
0.1	0.003	0.025	100	60,000
Notes	※1 Depth of Cut：ap=Axial Depth of Cut / ae=Radial Depth of Cut. ※2 Handle with care when exchanging and presetting tool. ※3 We recommend using oil mist coolant. ※4 Minimize chucking runout. (Recommend to measure actual runout at activated spindle speed.) ※5 Increase of Depth of Cut may cause a tool breakage, especially careful for Axial Depth of Cut.			

SMB120

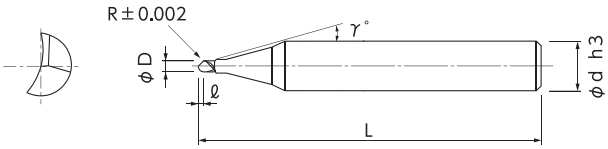
Size R0.01 ～ R0.05

CBN ≦70 HRC

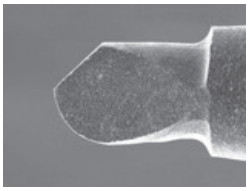
CBN Ball End Mill for precision machining "CBN Micro Ball"

Total 7 sizes

Realized micro milling by size line up R0.01 to R0.05



- The world's first CBN Micro Ball End Mill.
- Standarized sizes from R0.01.
- Realized sharp edge by maximizing features of CBN.



Cutting edge shape

Work Material

Prehardened Steel P	Hardened Steel H		
	～55HRC	～65HRC	～70HRC
○	◎	◎	○

Unit [Size : mm]

Code No.	Radius (R)	Length of Cut (ℓ)	Dia. (D)	Neck Taper Angle (γ)	Shank Dia. (d)	Overall Length (L)
01-00460-00010	R0.01	0.02	0.02	15°	4	50
01-00460-00015	R0.015	0.03	0.03	15°	4	50
01-00460-00020	R0.02	0.04	0.04	15°	4	50
01-00460-00025	R0.025	0.05	0.05	15°	4	50
01-00460-00030	R0.03	0.06	0.06	15°	4	50
01-00460-00040	R0.04	0.08	0.08	15°	4	50
01-00460-00050	R0.05	0.1	0.1	15°	4	50

How to Order When you order, indicate SMB120 (R). ※(γ) is reference value.

Recommended Milling Conditions

Work Material	Prehardened Steels・Hardened Steels NAK・STAVAX・SKD11・PD613 (～62HRC)				
Radius	Depth of Cut		Feed	Approaching Feed	Spindle Speed
	a_p mm	a_e mm	mm/min	mm/min	min^{-1}
0.01	0.0005	0.001	5	3	80,000
0.02	0.001	0.001	30	5	80,000
0.03	0.001	0.002	70	10	80,000
0.04	0.002	0.003	100	30	80,000
0.05	0.002	0.005	200	30	80,000

Notes

※1 Depth of Cut : a_p=Axial Depth of Cut / a_e=Radial Depth of Cut.
※2 Handle with care when exchanging and presetting tool.
※3 We recommend using oil mist coolant.
※4 Minimize chucking runout.
(Recommend to measure actual runout at activated spindle speed.)
※5 Tool approaching angle must be 3 degrees or below.
※6 Increase of Depth of Cut may cause a tool breakage, especially careful for Axial Depth of Cut.

SMB200 New

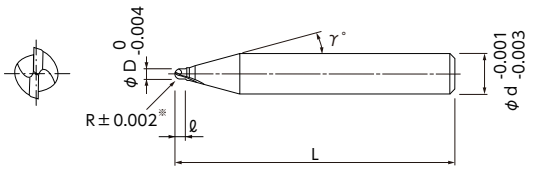
Size R0.01 ～ R0.05

CBN ≦70 HRC

CBN Micro 2-Flute Ball End Mill

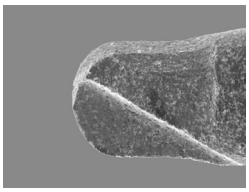
Total 7 sizes

2-flute shape specialized from R0.01
High precise specific micro end mill



※R accuracy is based on a half value of actual diameter

- Adopting 2-flute shape from R0.01 enables more efficient machining than conventional products.
- Realized sharp edge by maximizing features of CBN.
- Shank diameter tolerance is high accuracy type between -0.001mm and -0.003mm.



Cutting edge shape

Work Material

Prehardened Steel P	Hardened Steel H		
	～55HRC	～65HRC	～70HRC
○	◎	◎	○

Unit [Size : mm]

Code No.	Radius (R)	Length of Cut (ℓ)	Dia. (D)	Neck Taper Angle (γ)	Shank Dia. (d)	Overall Length (L)
01-00461-00010	R0.01	0.015	0.02	15°	4	48
01-00461-00015	R0.015	0.025	0.03	15°	4	48
01-00461-00020	R0.02	0.03	0.04	15°	4	48
01-00461-00025	R0.025	0.04	0.05	15°	4	48
01-00461-00030	R0.03	0.045	0.06	15°	4	48
01-00461-00040	R0.04	0.06	0.08	15°	4	48
01-00461-00050	R0.05	0.075	0.1	15°	4	48

How to Order When you order, indicate SMB200 (R). ※(γ) is reference value.

Recommended Milling Conditions

Work Material	Prehardened Steels・Hardened Steels NAK・STAVAX (～52HRC)					Prehardened Steels・Hardened Steels SKD11・PD613・ELMAX (～60HRC)					High Speed Steels SKH・HAP (～68HRC)				
Radius	Depth of Cut		Feed	Approaching Feed	Spindle Speed	Depth of Cut		Feed	Approaching Feed	Spindle Speed	Depth of Cut		Feed	Approaching Feed	Spindle Speed
	ap mm	ae mm	mm/min	mm/min	min^{-1}	ap mm	ae mm	mm/min	mm/min	min^{-1}	ap mm	ae mm	mm/min	mm/min	min^{-1}
0.01	0.0005	0.001	5	3	60,000	0.0005	0.001	5	3	60,000	0.0005	0.0005	3	1	60,000
0.015	0.001	0.001	30	5	60,000	0.001	0.001	20	5	60,000	0.0005	0.001	10	3	60,000
0.02	0.001	0.002	80	5	60,000	0.001	0.001	60	5	60,000	0.001	0.001	40	5	60,000
0.025	0.001	0.002	120	10	60,000	0.001	0.0015	100	10	60,000	0.001	0.001	60	5	60,000
0.03	0.002	0.002	180	10	60,000	0.001	0.002	140	10	60,000	0.001	0.001	80	10	60,000
0.04	0.003	0.003	280	30	60,000	0.002	0.003	200	30	60,000	0.002	0.002	120	20	60,000
0.05	0.005	0.005	400	30	60,000	0.003	0.005	300	30	60,000	0.002	0.003	180	20	60,000

Notes

※1 Depth of Cut：ap=Axial Depth of Cut / ae=Radial Depth of Cut.
※2 Handle with care when exchanging and presetting tool.
※3 We recommend using oil mist coolant.
※4 Minimize chucking runout.
(Recommend to measure actual runout at activated spindle speed.)
※5 Tool approaching angle must be 3 degrees or below.
※6 Increase of Depth of Cut may cause a tool breakage, especially careful for Axial Depth of Cut.

Neck modification is available

Long neck shape Taper neck shape

Neck modification is available.
Please ask for details.

NSME100

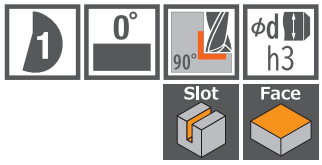
Size ϕ 0.01 ~ ϕ 0.05

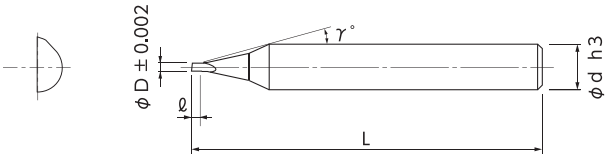
SMG ≦40 HRC

Micro End Mill "MICRO EDGE"

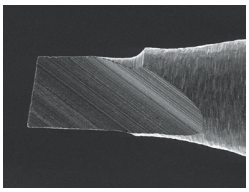
Total 5 sizes

Smallest Dia.0.01mm
Single straight flute end mill for ultra micro milling





- Ultra-high-precision accuracy is guaranteed with ±2μm tolerance of flute diameter and h3 tolerance of shank diameter (circularity 0.1μm).
- One straight flute, 5 items from 0.01 to 0.05mm diameter.



Cutting edge shape

Work Material

Carbon Steel P	Alloy Steel P	Prehardened Steel P	Stainless Steel M	Aluminium Alloy N	Copper N	Resin O
○	○	○	○	○	○	○

Unit [Size : mm]

Code No.	Dia. (D)	Length of Cut (ℓ)	Neck Taper Angle (γ)	Shank Dia. (d)	Overall Length (L)
01-00001-00010	0.01	0.01	15°	4	45
01-00001-00020	0.02	0.02	15°	4	45
01-00001-00030	0.03	0.03	15°	4	45
01-00001-00040	0.04	0.04	15°	4	45
01-00001-00050	0.05	0.05	15°	4	45

How to Order When you order, indicate NSME100 (D). ※(γ) is reference value.

Recommended Milling Conditions

Work Material	Tough Pitch Copper・Aluminium Alloy			
Dia	Depth of Cut		Feed	Spindle Speed
	ap mm	ae mm	mm/min	min^{-1}
0.01	0.0001	0.0005	10	60,000
0.02	0.0003	0.001	15	60,000
0.03	0.0005	0.001	20	60,000
0.04	0.001	0.001	20	60,000
0.05	0.001	0.002	30	60,000
Notes	※1 Depth of Cut：ap=Axial Depth of Cut / ae=Radial Depth of Cut. ※2 Handle with care when exchanging and presetting tool. ※3 We recommend using oil mist coolant. ※4 Minimize chucking runout. (Recommend to measure actual runout at activated spindle speed.) ※5 Increase of Depth of Cut may cause a tool breakage, especially careful for Axial Depth of Cut.			

NSME230

Size ϕ 0.03 ~ ϕ 0.09

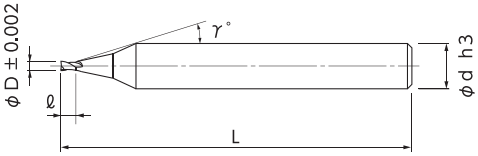
SMG ≦40 HRC

Micro End Mill MICRO EDGE"

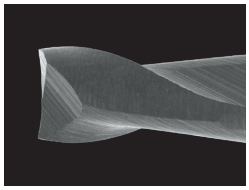
Total 7 sizes

2 flute 30°square end mill for micro milling. Dia. 0.03mm to Dia. 0.09mm

2 | 30° | ϕd h3 | Slot | Face



- Ultra-high-precision accuracy is guaranteed with ±2μm tolerance of flute diameter and h3 tolerance of shank diameter (circularity 0.1μm).
- Two flutes in 30 deg. 7 items from 0.03 to 0.09mm diameter.



Cutting edge shape

Work Material

Carbon Steel P	Alloy Steel P	Prehardened Steel P	Stainless Steel M	Aluminium Alloy N	Copper N	Resin O
○	○	○	○	○	○	○

Unit [Size : mm]

Code No.	Dia. (D)	Length of Cut (ℓ)	Neck Taper Angle (γ)	Shank Dia. (d)	Overall Length (L)
01-00002-00030	0.03	0.045	15°	4	45
01-00002-00040	0.04	0.060	15°	4	45
01-00002-00050	0.05	0.075	15°	4	45
01-00002-00060	0.06	0.090	15°	4	45
01-00002-00070	0.07	0.105	15°	4	45
01-00002-00080	0.08	0.120	15°	4	45
01-00002-00090	0.09	0.135	15°	4	45

How to Order When you order, indicate NSME230 (D). ※(γ) is reference value.

Recommended Milling Conditions

Work Material	Tough Pitch Copper・Aluminium Alloy			
Dia	Depth of Cut		Feed	Spindle Speed
	ap mm	ae mm	mm/min	min^{-1}
0.03	0.0015	0.002	20	60,000
0.04	0.0015	0.002	25	60,000
0.05	0.002	0.003	30	60,000
0.06	0.002	0.004	40	60,000
0.07	0.0025	0.005	50	60,000
0.08	0.003	0.005	70	60,000
0.09	0.004	0.01	80	60,000

Notes

※1 Depth of Cut：ap=Axial Depth of Cut / ae=Radial Depth of Cut.
※2 Handle with care when exchanging and presetting tool.
※3 We recommend using oil mist coolant.
※4 Minimize chucking runout.
(Recommend to measure actual runout at activated spindle speed.)
※5 Increase of Depth of Cut may cause a tool breakage, especially careful for Axial Depth of Cut.

NSMB100

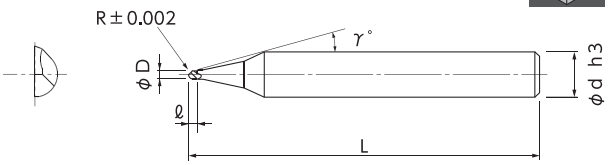
Size R0.005 ～ R0.05

SMG ≦40 HRC

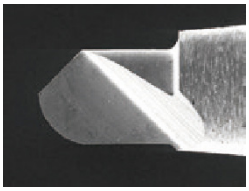
Ball End Mill for precision machining "Micro Ball"

Total 8 sizes

Standardized from the smallest R0.005 for ultra micro milling



- The world's first standardization of Ball size R0.005. Micro Ball develops new machining field in high-precision technology.
- The world's smallest ball end mill "Micro Ball" extends precision machining field.
- NS original R design exericises fine finishing surface.



Cutting edge shape

Work Material

Carbon Steel P	Alloy Steel P	Prehardened Steel P	Stainless Steel M	Aluminium Alloy N	Copper N	Resin O
○	○	○	○	○	○	○

Unit [Size : mm]

Code No.	Radius (R)	Length of Cut (ℓ)	Dia. (D)	Neck Taper Angle (γ)	Shank Dia. (d)	Overall Length (L)
01-00003-00005	R0.005	0.01	0.01	15°	4	45
01-00003-00010	R0.01	0.02	0.02	15°	4	45
01-00003-00015	R0.015	0.03	0.03	15°	4	45
01-00003-00020	R0.02	0.04	0.04	15°	4	45
01-00003-00025	R0.025	0.05	0.05	15°	4	45
01-00003-00030	R0.03	0.06	0.06	15°	4	45
01-00003-00040	R0.04	0.08	0.08	15°	4	45
01-00003-00050	R0.05	0.1	0.1	15°	4	45

How to Order When you order, indicate NSMB100 (R). ※(γ) is reference value.

Recommended Milling Conditions

Work Material	Tough Pitch Copper・Aluminium Alloy				
Radius	Depth of Cut		Feed	Approaching Feed	Spindle Speed
	ap mm	ae mm	mm/min	mm/min	min^{-1}
0.005	0.0003	0.0005	5	2	60,000
0.01	0.0005	0.001	10	3	60,000
0.02	0.001	0.002	20	5	60,000
0.03	0.002	0.003	80	10	60,000
0.04	0.002	0.004	200	30	60,000
0.05	0.003	0.005	300	30	60,000

Notes

※1 Depth of Cut: ap=Axial Depth of Cut / ae=Radial Depth of Cut.
※2 Handle with care when exchanging and presetting tool.
※3 Use proper type of coolant for material and machining process.
※4 Minimize chucking runout
(Recommend to measure actual runout at activated spindle speed.)
※5 Tool approaching angle must be 3 degrees or below.
※6 Increase of Depth of Cut may cause a tool breakage, especially careful for Axial Depth of Cut.

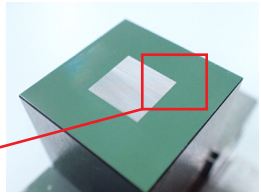
Machining case 1

Micro Lens array

Realizes micro precision machining with high R accuracy of ±0.002 mm

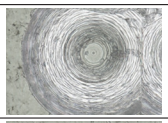
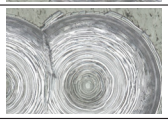
SMB200

Work material：STAVAX (52HRC)
Work size：9 × 9 mm
(Machining depth 0.03mm)
Coolant：Oil mist
Total machining time：93hr 57min



Process	Roughing	Finishing
Tool	SSBL200 R0.05 × 0.3	SMB200 R0.03
Spindle speed [min^{-1}]	60,000	60,000
Feed [mm/min]	100	30
Depth of cut ap × ae [mm]	0.005×0.005	0.001×0.001
Machining time	36hr 16min	57hr 41min

SR shape 22,500pcs

	Enlarged photo (x2,000)	Surface roughness [μm]	Depth [mm] Target : 0.030	Accuracy [mm] Target : R0.050
At the beginning of machining 1st		Ra : 0.078	0.031	R0.050
At the end of machining 22,500th		Ra : 0.085	0.030	R0.049

Machining case 2

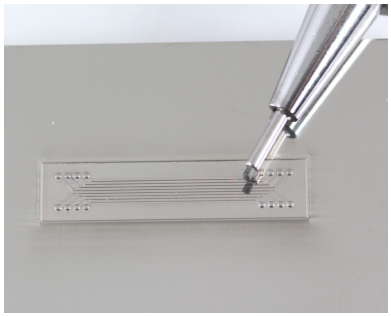
Microfluidic device

Realized stable dimension accuracy on machining hardened steels

SMEZ120

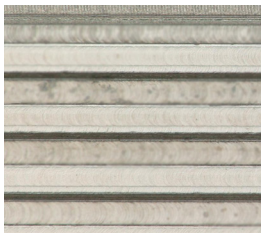
Work material：STAVAX (52HRC)
Work size：15 × 15 mm
(Machining depth 0.05mm)
Coolant：Oil mist
Total machining time：5hr 57min

Process	Semi-Finishing	Finishing 1	Finishing 2
Tool	SSBL200 R0.2 × 1.2	SSBL200 R0.1 × 0.6	SMEZ120 ϕ0.1
Spindle speed [min^{-1}]	60,000		60,000
Feed [mm/min]	1,200	200	50
Depth of cut ap × ae [mm]	0.005×0.01	0.005×0.005	0.003×0.005 ～0.1
Machining time	3hr 9min	44 min	2hr 4min



Flow width (凸)
Target 0.1000 mm
Actual 0.0964mm

Surface Roughness (凸)
Ra 0.04 μm
Rz 0.58 μm



Surface Roughness (凹)
Ra 0.06 μm
Rz 0.96 μm

Flow width (凹)
Target 0.1000mm
Actual 0.1036mm

Machining case 3

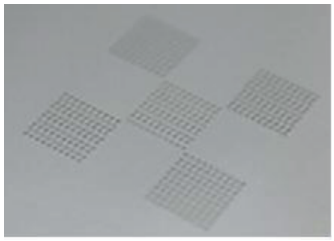
Micro Pocket Machining

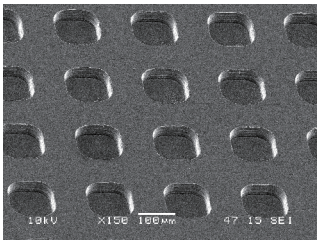
500 - 0.1mm fine pocket machining

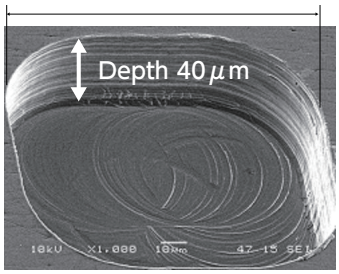
NSME100

Work material：Aluminium Alloy A7075
Pocket size：0.1 × 0.1 × 0.04 mm
Coolant：Oil mist
Total machining time：40 hr / 500 Pocket
(4min 48sec / 1 Pocket)

Process	Finishing
Tool	NSME100 ϕ0.05
Spindle speed [min^{-1}]	30,000
Feed [mm/min]	10
Depth of cut ap x ae [mm]	0.002×0.002
Machining time	4min 48sec / 1Pocket







Machining case 4

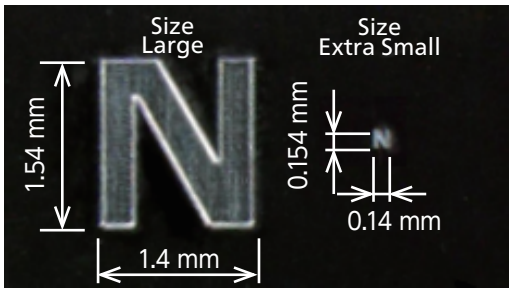
N Characters

Engraving of tiny characters into mold cavities and cores

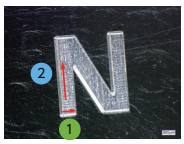
NSMB100

Work material：NAK80 (40HRC)
Character size：
Large 1.4 × 1.54 mm
Extra Small 0.14 × 0.154 mm
Coolant：Oil mist
Total machining time：3hr 10min

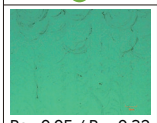
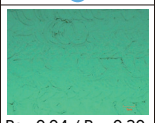
Process	Character large	Character Extra small
Tool	NSMB100 R0.05	NSMB100 R0.005
Spindle speed [min^{-1}]	60,000	60,000
Feed [mm/min]	300	5
Depth of cut ap x ae [mm]	0.003×0.005	0.0003×0.0005
Machining time	40 min	2hr 30min



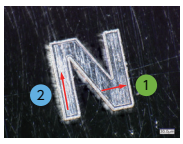
Text size Large



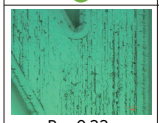
Unit [μm]

1	2
	
Ra : 0.05 / Rz : 0.32	Ra : 0.04 / Rz : 0.30

Text size Extra small



Unit [μm]

1	2
	
Rz : 0.33	Rz : 0.57

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CAUTION **Attention on Safety**

1) When removing tools from cases, be careful of getting-out of tools and don't touch directly the cutting edges.
2) Never touch the cutting edges directly with bare hand.
3) Use safety covers and eye protection, as tools may be broken.
4) Use holders, etc. that match the tools and nature of the processing operations. The tool should be firmly attached to the holder to prevent shaking.
5) The work materials clamp firmly.
6) Make sure of dimensions of tools and work pieces before starting operation.
7) It is necessary to adjust conditions according to the dimensions of work materials and the machine.
8) Select a cutting fluid appropriate to the particular usage. Using a non-water cutting fluid could lead to fires due to sparks generated during processing or heat caused by breakage. Ensure that you take proper fire-prevention measures.
9) If abnormal sound, etc. occurs during processing, stop the machine immediately.
10) Don't modify tools.

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Specifications may change without notice for improvement.