

日进工具自主研发的涂层介绍 NS TOOL Original Coating

无限
白金涂层

无限白金涂层 MUGEN-COATING PREMIUM

对高硬度材料进行直接切削加工时，无限白金涂层可大幅提高刀具的使用寿命。涂膜硬度Hv3,600，耐氧化性高，氧化开始温度高达1,300℃，适用于48~65HRC的高硬度材料加工。

MUGEN-COATING PREMIUM has brought the tool life extension for the machining of high hardened steels. It is suited for hardened steels from 48 to 65 HRC with high coating hardness: 3,600Hv and oxidation onset temperature: 1,300deg. C.

无限
涂层

无限涂层 MUGEN-COATING

无限涂层是以TiAlN(氮化铝铁)为基底的涂层，涂膜硬度Hv3,400，耐氧化性高，氧化开始温度高达1,100℃。加工淬火钢、预硬钢、生材、铜时，也具有很强的耐磨损性和润滑性。

MUGEN-COATING consists of TiAlN (Titanium Aluminum Nitride) with coating hardness: 3,400Hv and oxidation onset temperature: 1,100deg. C. It covers wide range of work materials such as hardened steels, pre-hardened steels, raw materials and even coppers as being strong tool wear resistance and lubricating ability.

X涂层

X涂层 (TiCN类) X-COATING

X涂层是TiCN(氮化钛)类的涂层。涂膜硬度高达HV3,000，涂层的粘合性极佳。使用湿式冷却来缓解切削热量的切削加工(切削速度100m/min以下)时，威力超群。

X-COATING consists of TiCN (Titanium Carbon Nitride) with coating hardness: 3,000Hv and high adhesion. It is recommended for general use of various materials at less than 100m/min cutting speed with coolant fluid.

DLC
涂层

DLC涂层 DLC COATING

DLC(类似钻石碳素)涂层是具有类似钻石性质的碳涂膜，兼具钻石和石墨特性的非晶格结构的涂层。硬度高达HV6,000，摩擦系数仅0.1，涂膜的表面粗糙度Ra0.02μm，非常光滑。而且耐熔敷性能优异，加工铝合金时可保持优良的精加工表面。

DLC (Diamond like Carbon) is a carbon coating similar to diamond coating. It is suited for the high accurate surface milling of Aluminum by the features of high coating hardness: 6,000Hv, low friction coefficient: 0.1 and strong welding resistance by smooth surface: Ra0.02 micro meter.

钻石
涂层

钻石涂层 DIAMOND COATING

不含结合剂和杂质的高纯度钻石，具有优异的耐磨损性，采用高粘性的结合技术，可实现极高的稳定性。

Stable quality brought by strong wear-resistance and stickiness of pure diamond free from bond and impurity.

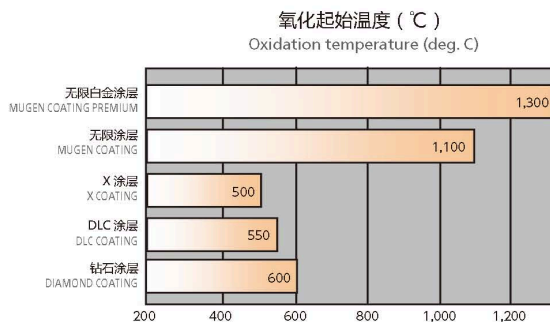
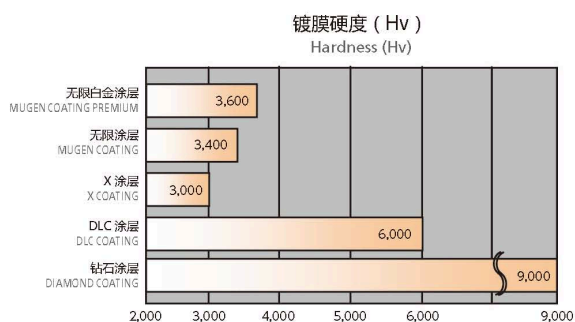
各种涂层的加工材料适用表 Coating application chart by materials

涂层种类 Coating		无限白金涂层 MUGEN-COATING PREMIUM	无限涂层 MUGEN-COATING	X涂层 X-COATING	DLC涂层 DLC COATING	钻石涂层 DIAMOND COATING
加工材料 Materials	淬火钢 56~65HRC Hardened Steels	◎	◎			
	淬火钢 45~55HRC Hardened Steels	◎	◎	○		
	预硬钢 Pre-hardened Steels	◎	◎	◎		
	生材 Soft Irons	◎	◎	◎		
	铜合金 Copper	○	◎	◎	◎	
	铝合金 Aluminum	○	○	◎	◎	
	脆性材料 Brittle Materials					◎
	石墨 Graphite					◎

涂层型硬质合金铣刀 Coated Cemented Carbide End Mill

涂层型硬质合金铣刀是在硬质合金铣刀的刀部表面，增加1层或多层碳化物、氮化物、氧化物、钻石等化学或物理涂层的铣刀。涂层种类丰富，可根据用途和工件材料选择最适用的种类。

Coated Cemented Carbide End Mill is the cutting tool that one or more layers of coating materials such as carbide, nitride, oxide or diamond are chemically or physically adhered on flutes. Most suitable type of coating can be selected from among variety of coatings, which should be fit for the work material.



无限白金涂层 MUGEN-COATING PREMIUM

无限白金涂层是对传统无限涂层的进一步改良，直接加工高硬度材料时，可大幅延长刀具的使用寿命。涂层硬度 Hv3,600，耐氧化温度高达 1,300°C，适用于 48 ~ 65HRC 的高硬度材料。

MUGEN COATING PREMIUM, improved from existing Mugen coating is suited for direct machining of hardened steels with extended tool life. By the hardness Hv3,600 and the oxidation temperature 1,300deg.C, it is recommended for hard materials from 48 to 65 HRC.

HAP40 65HRC (粉末钢 HSS) Powder HSS

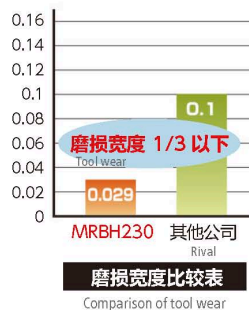


MRBH230 R1 × 6

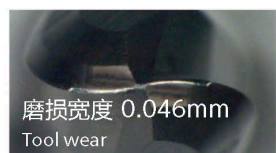


其他公司 高硬度材料用
Rival

n : 20,000min⁻¹ Vf : 1.600mm/min ap0.15mm × ae0.3mm
油雾 加工时间 : 18分钟 切削长度 : 25m
Oil mist Cutting time : 18min Cutting length : 25m



PD613 60HRC (SKD11)

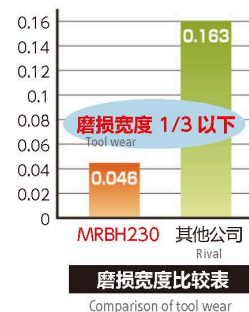


MRBH230 R1 × 6



其他公司 高硬度材料用
Rival

n : 25,000min⁻¹ Vf : 2.000mm/min ap0.2mm × ae0.3mm
油雾 加工时间 : 62分钟 切削长度 : 100m
Oil mist Cutting time : 62min Cutting length : 100m



NS 铣刀的特点

Features of NS End Mill

无限涂层 MUGEN-COATING

无限涂层是以 TiAlN (氮化铝钛) 为基底的涂层, 涂膜硬度 Hv3,400, 耐氧化起始温度高达 1,100°C。加工淬火钢 (60HRC)、预硬钢、生材、铜等时, 也具有很强的耐磨损性和润滑性。并且, 冷却方式可使用水溶性切削油、吹气、油雾冷却等, 是不挑“加工材质和冷却方式”的优质涂层。

MUGEN-COATING with the hardness Hv3,400 and the oxidation temperature 1,100deg.C, based on TiAlN (Titanium Aluminum Nitride) is recommended for various materials such as hardened steel(60HRC), pre-hardened steel, raw steel and copper because of strong wear-resistance and high lubricity. In addition, any kind of cutting fluid is available such as water soluble, oil, air blow and oil mist.

STAVAX 52HRC (SUS420J2 改)



磨损宽度 0.087mm

Tool wear

MRB230 R1 × 10



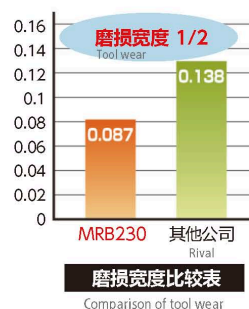
磨损宽度 0.138mm

Tool wear

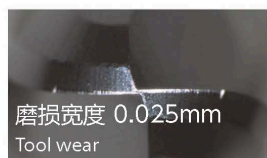
其他公司

Rival

n : 10,000min⁻¹ Vf : 1,500mm/min ap0.1mm × ae0.2mm
水溶性切削油 加工时间 : 132分钟 切削长度 : 150m
Water soluble fluid Cutting time : 132min Cutting length : 150m



铜 Copper



磨损宽度 0.025mm

Tool wear

MRB230 R1 × 20



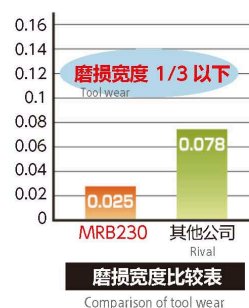
磨损宽度 0.078mm

Tool wear

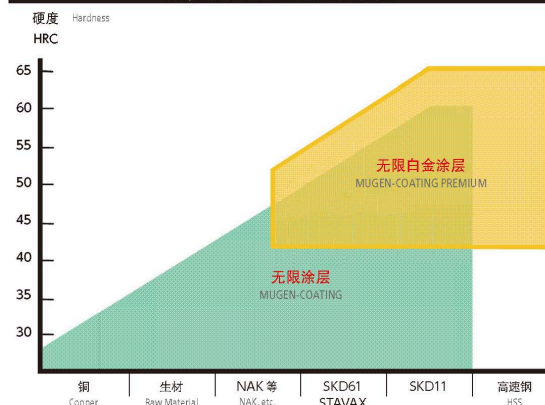
其他公司 CrN

Rival

粗加工 n : 12,000min⁻¹ Vf : 1,200mm/min ap0.2mm × ae0.3mm
Roughing
精加工 n : 5,000min⁻¹ Vf : 700mm/min ap0.05mm × ae0.03mm
Finishing
水溶性切削油 加工时间 : 8小时54分钟
Water soluble fluid Cutting time : 8hr 54min



无限系列涂层的适用范围



■ 无限微细涂层 MUGEN MICRO COATING

为微小径钻头专门开发的超微细涂层。覆膜表面无异物附着，覆膜是小于 $1\mu\text{m}$ 的超薄涂层，即使对微小径钻头进行镀层也无损其形状精度。对钢材 - SUS材进行钻孔加工时，可延长其寿命，发挥其优异性能。

The ultra thin Micro Coating is exclusively developed for Micro Drill series. Under $1\mu\text{m}$ thickness with no impure substances on the surface maintains the precise shape accuracy of Micro Drill as well as high performance by extended drilling life on steels include stainless steels.

■ X 涂层 (TiCN 类) X-COATING (TiCN)

X 涂层是 TiCN(氮化钛)类的涂层。涂膜硬度高达 Hv3,000，涂层的粘合性极佳，但具有耐热性低 (500°C) 的缺点，无法承受切削速度在 $100\text{m}/\text{min}$ 以上的高速加工时所产生的切削热量。因此，为降低切削产生的热量，采用湿式冷却的切削加工 (切削速度在 $100\text{m}/\text{min}$ 以下) 可发挥其优势。

X COATING is based on TiCN(Titanium Carbon Nitride). The hardness is Hv3,000 with strong adhesion but cutting speed higher than $100\text{m}/\text{min}$ is not recommended because the oxidation temperature is low at 500°C . Accordingly X COATING performs well at medium cutting speed lower than $100\text{m}/\text{min}$ with water soluble cutting fluid.

■ DLC 涂层 DLC COATING

DLC (类钻石碳) 涂层是具有类似钻石性质的碳素涂层，兼具钻石和石墨特性的非晶格结构的涂层。特点是硬度高达 Hv6,000，且摩擦系数仅 0.1，涂膜表面粗糙度为 $\text{Ra}0.02\mu\text{m}$ ，非常光滑，并具有很好的耐熔融性，在铝合金等的加工中可维持良好的精加工面，并且刀具的使用寿命长。但是，因其是碳涂膜，所含的碳素容易与铁质金属发生结合，不适用于铁类工件的加工。因此，适用于有色金属材料特别是铝合金等的加工。

DLC (Diamond Like Carbon) COATING is very hard amorphous coating with similar characteristic as diamond. It is recommended for the finishing of aluminum alloy as being high hardness Hv6,000, friction coefficient 0.1, smooth surface roughness $\text{Ra}0.02\mu\text{m}$ and with anti-welding feature. However it is not suited for steel materials but good for nonferrous metals because DLC is the carbon base coating.

■ 钻石涂层 DIAMOND COATING

钻石涂层是由细微的钻石结晶集合而成的多结晶膜。具有天然钻石标准的硬度，耐磨性优异。由于硬质合金刀具表面实施了钻石涂层处理，因此刀具形状的自由度高。采用耐磨损性优异，不含结合剂和杂质的高纯度钻石，凭借紧密结合技术，从石墨加工到至今仍难以加工的硬脆工件切削，均可实现刀具寿命的高稳定性。DIAMOND COATING is a minute polycrystalline film, as hard as natural diamond and with strong wear-resistance. There is no limit of tool shape as DIAMOND COATING is given on the Cemented Carbide surface. Stable coating quality has been ensured long tool life against graphite and brittle materials by strong wear-resistance and adherence brought by pure diamond without binders and impurities.