Hard Part Turning with CBN Inserts

Zhengzhou Halnn Superhard Materials Co., Ltd
Hard Part Turning

- What is hard turning?
- Characteristics of hard turning (VS Grinding)
- Hard Turning and the cutting tools history
- Typical application case of hard turning
- Hann Innovation of hard turning
What is hard turning?

The so-called hard turning refers to one process that make hardened steel turning as the final processing or finishing process. Hardened steel usually refers to one type materials that include martensite after quenching, high hardness, high strength, almost no plastic.

When hardened steel hardness $> 55$HRC, its strength is about $2100 \sim 2600$N/mm$^2$. Normally, the work piece has already been rough machined before heat treatment, and only left finishing process.
Advantages of hard turning:

- Lower Initial Capital Investment
- Lower Cycle Times
- Machining Flexibility
- Obtain good surface
- Environmental

Hard Turning VS Grinding
Before the nineteen nineties, turning is still only applied to roughing before quenching, finishing after quenching still used grinding method. The traditional processing technology is rough car - heat treatment (quenching) - grinding.

In the early nineties, hard turning really began to develop. With the continuous development of the machinery manufacturing industry, more and more hard-to-machine materials and complex materials appear, and the traditional tool materials have been difficult to handle or can not realize the processing of high-strength and high-hardness materials at all. Modern tool materials such as ceramic inserts and PCBN inserts make it possible for hard turning.
History of cutting tools materials

1. Single crystal diamond
2. Low Content CBN
3. Ceramic
4. High content CBN
5. PCD
6. CVD Diamond
7. Metal Ceramic
8. Tungsten Carbide
9. High Speed Steel
0. Ideal Cutting Tools Materials
Common Application of CBN Inserts

- Automotive
- Construction machinery
- Pump
- Bearings
- Rollers
- Aerospace
- Other Industry 8%

% of PCBN Consumed
<table>
<thead>
<tr>
<th>Halnn CBN Grade</th>
<th>Binder</th>
<th>CBN Content (%)</th>
<th>Granularity</th>
<th>Hardness</th>
</tr>
</thead>
<tbody>
<tr>
<td>BN-S20</td>
<td>TIN</td>
<td>76</td>
<td>4~6</td>
<td>2900-3100</td>
</tr>
<tr>
<td>BN-S200</td>
<td>TIN</td>
<td>60</td>
<td>2~4</td>
<td>2800-3000</td>
</tr>
<tr>
<td>BN-H11</td>
<td>TIN</td>
<td>70</td>
<td>2~4</td>
<td>2800-3000</td>
</tr>
<tr>
<td>BN-H20</td>
<td>TIC</td>
<td>80</td>
<td>2~4</td>
<td>3100-3300</td>
</tr>
<tr>
<td>BN-H05</td>
<td>TIN</td>
<td>45</td>
<td>≤1</td>
<td>2700-2800</td>
</tr>
<tr>
<td>BN-H10</td>
<td>TIN</td>
<td>50</td>
<td>≤1</td>
<td>2700-2800</td>
</tr>
<tr>
<td>BN-H21</td>
<td>AL, TINC</td>
<td>60</td>
<td>1~2</td>
<td>2600-2800</td>
</tr>
<tr>
<td>BN-H05 C25</td>
<td>TIN</td>
<td>45</td>
<td>≤1</td>
<td>2700-2800</td>
</tr>
<tr>
<td>BN-H10 C25</td>
<td>TIN</td>
<td>50</td>
<td>≤1</td>
<td>2700-2800</td>
</tr>
<tr>
<td>BN-H21 C25</td>
<td>AL, TINC</td>
<td>60</td>
<td>1~2</td>
<td>2600-2800</td>
</tr>
<tr>
<td>CBN Content</td>
<td>Characteristics</td>
<td>Insert Grade</td>
<td>Depth of Cut (mm)</td>
<td>Recommend Cutting condition</td>
</tr>
<tr>
<td>--------------</td>
<td>----------------</td>
<td>--------------</td>
<td>------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>Low Content CBN</td>
<td>Toughness (Roughing)</td>
<td>BN-S20</td>
<td>1-10mm</td>
<td>Interrupt-Continuous</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BN-H20</td>
<td>≤1mm</td>
<td>Semi-Interrupt</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BN-S200</td>
<td>≤1mm</td>
<td>Continuous</td>
</tr>
<tr>
<td></td>
<td>Hardness (Finishing)</td>
<td>BN-H11</td>
<td>≤1mm</td>
<td>Continuous</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BN-H05</td>
<td>≤0.2mm</td>
<td>Continuous</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BN-H10</td>
<td>≤0.5mm</td>
<td>Continuous-Semi-interrupt</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BN-H21</td>
<td>≤0.5mm</td>
<td>Semi-interrupt—Heavy Interrupt</td>
</tr>
<tr>
<td></td>
<td>Toughness</td>
<td>BN-H05 C25</td>
<td>≤0.2mm</td>
<td>Continuous</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BN-H10 C25</td>
<td>≤0.5mm</td>
<td>Continuous-Semi-Interrupt</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BN-H21 C25</td>
<td>≤0.5mm</td>
<td>Semi-Interrupt—Heavy Interrupt</td>
</tr>
</tbody>
</table>
Halnn CBN Insert Type

- Solid CBN Insert
- PCBN Insert
- Coating PCBN
- Brazed PCBN
- Other Type PCBN
The key to success of hard turning

（1）**Hard turning stability**: Continuous hard turning gear endsurface or inner bore already not a difficult problem, but when machining deep hole, contouring cutting grooves, it belongs to for interrupt turning condition, because of the complex process, we need to consider more information, such as hard turning lathe, Fixture, tool material, program design etc.

（2）**Hard turning economy**: Not all the hard turning process will lower the costs and improve the efficiency comparing grinding process. Sometimes, we need to use special grinding machine or grinding wheel. So for hard turning process, we need to value that if it is suitable.

（3）**Hard turning roughness**: Common materials include 20CrMnTi, 16Mn5, 42CrMo etc. The hardness after heat treatment will reach about HRC58~62, the roughness will require within Ra0.8, some will require Ra0.4. Halnn CBN Insert can meet all the requirements, and Halnn wiper insert and coating pcbn insert also improve the efficiency and the surface quality, extend the tools life.
Hard Turning typical application
Hard turning automotive Transmission gear shaft

Interrupt turning

CNC Lathe

Before Machining

After machining

Only one step

Previous Insert
Kyocera KBN25M

Current PCBN
Halnn BN-H10
Component: Transmission gear shaft
Materials: 20CrMo
Hardness: 62-65HRC
Selected Insert: BN-H10 VNGA160408
Cutting Parameters: Vc=132m/min, ap=0.1mm, fr=0.15mm/r
Roughness: Ra1.6
Coolant Method: Wet Cutting

<table>
<thead>
<tr>
<th>CBN Materials</th>
<th>Select Insert</th>
<th>Cutting Speed Vc (m/min)</th>
<th>Average tool life (pieces/tip)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kyocera PCBN</td>
<td>KBN25M VNGA160408S01225</td>
<td>132</td>
<td>100</td>
</tr>
<tr>
<td>Halnn PCBN</td>
<td>BN-H10 VNGA160408T01535</td>
<td>132</td>
<td>145</td>
</tr>
</tbody>
</table>

With Halnn BN-H10, tool life improved 45%!
• **Definition of Interrupt turning:**
  - Heavy Interrupt: Broken Slot $\theta<40^\circ$, or it exists 5 or more holes on the machining surface,
  - Semi-Interrupt: Broken Slot $90^\circ > \theta > 40^\circ$, or it exists 2~4 holes,
  - Light Interrupt: Broken Slot $\theta > 90^\circ$, or it exists 1 hole, or slot.
BN-H05 Continuous turning Gear Inner Bore

Machining Condition: Continuous Turning
Materials: 20CrMnTi Gears,
Hardness: HRC58-62
Selected Insert: BN-H05 CNGA120408
Cutting Condition: ap=0.1mm, Fr=0.1mm/r, Vc=180m/min, Dry Cutting

<table>
<thead>
<tr>
<th>Insert Materials</th>
<th>Roughness</th>
<th>Tool Life</th>
</tr>
</thead>
<tbody>
<tr>
<td>Halnn BN-H05</td>
<td>≤Ra0.8</td>
<td>800 pieces</td>
</tr>
<tr>
<td>Other Brand PCBN</td>
<td>Ra1.0</td>
<td>550 pieces</td>
</tr>
</tbody>
</table>

BN-H05 Tool life will improve 45%!
BN-H10 Light Interrupt turning Gear inner bore

When machining the Gears inner bore with slot, it will produce large impact force for the gear inner bore, which belong to interrupt turning condition. Specific for this interrupt turning condition, Halnn recommend BN-H10 PCBN Insert for light interrupt, application case as follows:

<table>
<thead>
<tr>
<th>Machining Condition:</th>
<th>Semi-Interrupt turning inner bore</th>
</tr>
</thead>
<tbody>
<tr>
<td>Materials:</td>
<td>20CrMnTi Gears, HRC58~62</td>
</tr>
<tr>
<td>Selected Insert:</td>
<td>BN-H10 CCGW09T304</td>
</tr>
<tr>
<td>Cutting Condition:</td>
<td>ap=0.25mm,Fr=0.08mm/r,Vc=135m/min,dry cutting</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cutting Tools Materials</th>
<th>Cutting Speed</th>
<th>Tool Life</th>
<th>Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Halnn BN-H10</td>
<td>135m/min</td>
<td>1000 pieces</td>
<td>Improved 22%</td>
</tr>
<tr>
<td>Other PCBN</td>
<td>110m/min</td>
<td>600 pieces</td>
<td>----</td>
</tr>
</tbody>
</table>

Halnn BN-H10 efficiency improve 22%, tool life improve 66%,
BN-H21 heavy interrupt finishing gear endsurface

When the gear endsurface have many holes, it will have much impact force in the process, which belongs to heavy interrupt turning condition, Halnn BN-H21 is researched specific for heavy interrupt turning condition, the following is one application case:

- **Machining Condition:** Heavy Interrupt turning condition
- **Materials:** 20CrMnTi Gear, HRC58-62
- **Selected Insert:** BN-H21 WNMG080404
- **Cutting Condition:** ap=0.15mm, Fr=0.1mm/r, Vc=117m/min, Dry Cutting

<table>
<thead>
<tr>
<th>Selected Insert</th>
<th>Tool Life</th>
<th>Failure Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Halnn BN-H21</td>
<td>600 pieces</td>
<td>Normal Wear</td>
</tr>
<tr>
<td>Other PCBN</td>
<td>100 pieces</td>
<td>Damage Broken</td>
</tr>
</tbody>
</table>

Halnn BN-H21 improve 5 times, and also be normal wear.
BN-H20 hard turning synchronizer gear sleeve

<table>
<thead>
<tr>
<th>Insert Materials</th>
<th>Cutting Speed Vc</th>
<th>Tool Life</th>
<th>Failure Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Halnn BN-H20</td>
<td>180m/min</td>
<td>350pcs/tip</td>
<td>Normal Wear</td>
</tr>
<tr>
<td>Ceramic Insert</td>
<td>120m/min</td>
<td>70pcs/tip</td>
<td>Damage</td>
</tr>
</tbody>
</table>

Component: synchronizer gear sleeve  
Materials: Gear Steel (HRC58~63)  
Process: Finish turning gear sleeve (Continuous)  
Selected Insert: BN-H20 VNGA160404S01020  
Cutting Condition: ap=0.15mm, Fr=0.1mm/r, Vc=170m/min

With Halnn BN-H20, the lifetime improved 4 times!
BN-H10 Hard Turning wind power bearings raceway

Component: Wind Power Bearings 42CrMo, HRC58~62, Semi-Interrupt turning
Selected Insert: BN-H10 RNGN090300
Cutting Condition:
ap=1mm (Roughing), ap=0.15mm (Finishing)
Fr=0.45mm/r, Vc=145m/min, dry cutting

<table>
<thead>
<tr>
<th>Insert Materials</th>
<th>Cutting Speed</th>
<th>Tool Life</th>
<th>Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Halnn BN-H10</td>
<td>145m/min</td>
<td>3pcs/blade</td>
<td>Improve 20%</td>
</tr>
<tr>
<td>Other Brand</td>
<td>120m/min</td>
<td>2pcs/blade</td>
<td>----</td>
</tr>
</tbody>
</table>

Halnn BN-H10 Efficiency improve 20%
Tool life improve 50%

Processing Difficulties:
1. Wind Power Bearings common materials: 50Mn, 42CrMo, hardness: Above HRC50, it exist interrupt turning condition
2. Large working allowance, about 2~6mm
Halnn Coating PCBN application case 1

After coating, the smooth coating will combine with the cbn perfectly, which can obtain excellent cutting performance, improve the precision and the tool life comparing with the cbn insert without coating.

Component: Hub bearing unit,
Hardness: HRC58~62
Selected Insert: BN-H10 C25
Cutting Condition: Vc=180m/min;Fr=0.1mm/r;ap=0.15mm
Roughness: ≤Ra0.6
### Halnn Coating PCBN application case 1

<table>
<thead>
<tr>
<th>Insert Materials</th>
<th>Roughness</th>
<th>Tool Life (Pieces/insert)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other PCBN</td>
<td>Ra1.0</td>
<td>550</td>
</tr>
<tr>
<td>Halnn BN-H05</td>
<td>Ra≤0.8</td>
<td>800</td>
</tr>
<tr>
<td>Halnn BN-H05 C25 (Coating PCBN)</td>
<td>Ra≤0.8</td>
<td>1200</td>
</tr>
</tbody>
</table>

**Materials:** 20CrMnTi, HRC58~62  
**Insert Model:** BN-H05 CNGA120408  
**Cutting Condition:**  
- $ap=0.1\text{mm}$,  
- $Fr=0.1\text{mm/r}$,  
- $Vc=180\text{m/min}$,  
**Dry cutting**
Characteristics of BN-S20 hard turning Ball Screw

With the development of the cutting technology, the cutting tools manufacturers researched new tool materials “cubic boron nitride” which can be use for turning instead of grinding, it will have Compressive stress when with traditional cbn inserts roughing the ball screw raceway, it will be easily make the insert chipping. Finally Halnn research non-metal adhesive solid cbn inserts BN-S20, solving the problems of chipping

Advantages of Halnn solid cbn inserts BN-S20 hard turning ball screws;
(1) High hardness, abrasive resistance and heat resistance
(2) Strong impact resistance, avoid the insert chipping, damage problem
(3) High speed cutting, improve the efficiency
(4) Dry cutting method reduce the pollution
(5) Long tool life, will be 1.5~2 times of traditional cbn inserts.
BN-S20 hard turning Rolling screw ends

Materials: Rolling Screw Gcr15
Hardness: HRC60-62
Selected Insert: BN-S20 CNGN120708
Cutting Parameters: ap=4.5mm, Fr=0.10mm/r, Vc=95m/min, Dry Cutting

<table>
<thead>
<tr>
<th>Insert Materials</th>
<th>Cutting Speed</th>
<th>Cutting Depth</th>
<th>Failure Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Halnn BN-S20</td>
<td>95m/min</td>
<td>4.5mm</td>
<td>Normal Wear ★</td>
</tr>
<tr>
<td>Ceramic Insert</td>
<td>65m/min</td>
<td>0.5mm</td>
<td>Broken Damage</td>
</tr>
</tbody>
</table>

Halnn BN-S20 cutting depth will arrive 4.5mm, normal wear
BN-H10 hard turning ball screw raceway

Component: Ball Screw Thread, Gcr15
Hardness: HRC60–62
Selected Insert: BN-H10
Cutting Condition: Fr=0.10mm/r, Vc=150m/min, dry cutting

<table>
<thead>
<tr>
<th>Insert Materials</th>
<th>Roughness</th>
<th>Failure Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Halnn BN-H10</td>
<td>≤Ra0.8</td>
<td>Normal Wear</td>
</tr>
<tr>
<td>Other PCBN</td>
<td>Ra1.2–1.6</td>
<td>Damage or Broken</td>
</tr>
</tbody>
</table>

Halnn BN-H10 make roughness achieve Ra0.8, normal wear
Machining Characteristics of high speed steel

High speed steel, also called HSS, is a type tool steel with high hardness, high abrasive resistance and heat resistance, and is one of the hardest steel through heat treatment in ferrous metal materials, it is used for processing metal cutting tools, mold, rolls and typical parts, the hardness usually is HRC65~HRC68. Halnn has much experience on machining HSS Steel. The following will share you some application case.

High-speed steel as cutting tool material, the hardness will be HRC65 or higher, what cutting tools will you used for machining high hardness HSS?
BN-S20 hard turning high speed steel rolls

Materials: High speed steel
Hardness: HSD90
Selected Insert: BN-S20 RCMX120700
Cutting Condition: Fr=0.20mm/r, Vc=35m/min, dry cutting

<table>
<thead>
<tr>
<th>Insert Materials</th>
<th>Tool Life</th>
<th>Failure Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Halnn BN-S20</td>
<td>25</td>
<td>Normal wear ⭐</td>
</tr>
<tr>
<td>Other CBN</td>
<td>12</td>
<td>Damage Broken</td>
</tr>
</tbody>
</table>

The tool life of BN-S20 will be about 2 times of other CBN.

Processing Difficulties:
(1) High hardness
(2) Large working allowance
(3) Large cutting force
(4) It exists interrupt turning, the inserts will be easily chipping.
Case 1 Machining high speed steel

Materials: Powder high-speed tool steel (M2, M4, M5, M6)
Hardness: HRC65-HRC68

Process Difficulties:
Previous insert is international pcbn insert, the tool life is short when roughing, the reason is the inner wall of micro-deformation, resulting in the processing of intermittent turning hit the insert after Vacuum heat treatment, the blade loss is extremely large.

Solutions:
Machining Powder high-speed tool steel with hardness HRC65~67 after heat treatment with BN-H10 PCBN Insert (pcbn insert which can bear interrupt turning), it will have excellent performance.
Case 2 Machining high speed steel

Materials: High-speed tool steel
Hardness: HRC67-HRC68

Processing sequence:

Process Difficulties
(Next Page)
Process Difficulties:

a. Because of high cutting temperature, the current cbn insert will be easily damaged. (as right image)
b. The tool life is short, finishing 0.02mm with speed 600 r/min, the roughness will become not as well as before, and need change the insert frequently. If change the speed to 1000r/min, the roughness perform well, the tool life will be lower.

Tool Solutions:

1. Tool Structure: Because of HSS high hardness, and customers use customized tools, the insert damage easily, so we advise change to ISO Grooving Insert (as right image);
2. Insert Materials: It need to choose the cbn materials with high abrasive resistance, heat resistance and high hardness cbn grade BN-H05, which can meet all the requirements on the size, roughness, durability and the tool costs.
Case 3 Machining high speed steel

Lathe: OKUMA:
Materials: High Speed Steel (Hardness: HRC65~65)
Process Difficulties: 1. Interrupt turning (as following image)
2. Dimension tolerance: 0.005mm

Migraine Interrupt
Cylindrical intermittent
Inner Interrupt
Materials: High wear-resistant powder high-speed steel, HRC65
Machining Site: Heavy Interrupt turning Cylindrical
Selected Insert: BN-H21 CNGA120408
Cutting Condition: Fr=0.10mm/r, Vc=35~60m/min, ap=0.15mm, dry cutting

<table>
<thead>
<tr>
<th>Insert Materials</th>
<th>Insert Life</th>
<th>Failure Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Halnn BN-H21</td>
<td>5</td>
<td>Normal Wear</td>
</tr>
<tr>
<td>Other CBN</td>
<td>&lt;1</td>
<td>Broken Fragmentation</td>
</tr>
</tbody>
</table>

Testing Result:
Other Brand PCBN broken
Halnn CBN normal wear
Further consider produce coating pcbn, and improve the cutting efficiency.

Summary:
1. Machining high hardness component, and have heavy interrupt turning condition, the cutting speed is not large.
2. If the size tolerance is less 0.01mm, normally it need coolant, BN-H10 and BN-H21 can meet the requirements.
Processing Characteristics of Nickeal alloy spraying welding parts

Difficult factors of processing Nickel-based alloy

（1）Cutting Force will be 50% higher than 45# steel，the surface layer hardened after processing, the hardening up to 200%~500%, tool tip and the boundary wear is extremely seriously, the flank groove wear is also very easy to happen;

（2）Thermal conductivity is 1/5 ~ 1/2 of 45 steel, cutting temperature is high.

（3）Easily Bonding with the tool and produce BUE, which will affect the surface quality.

（4）The tungsten carbide, intermetallic compunds and other hard points will has stong impact on the insert.

（5）The workpiece will have irregular surface after surfacing or spraying process, and require high on the insert impact resistance.
BN-S20 hard turning Nickel based spraying component

Component: Nickel based alloy spraying, welding layer 2mm, HRC60
Selected Insert: BN-S200
Cutting Condition: Fr=0.25mm/r, ap=1.7mm, Vc=120m/min, dry cutting

<table>
<thead>
<tr>
<th>Insert Materials</th>
<th>Cutting Speed</th>
<th>Depth of Cut</th>
<th>Failure Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Halnn BN-S20</td>
<td>120 m/min</td>
<td>1.7mm</td>
<td>Normal Wear</td>
</tr>
<tr>
<td>Carbide Insert</td>
<td>16 m/min</td>
<td>0.6mm</td>
<td>Damaged Broken</td>
</tr>
</tbody>
</table>
BN-S20 hard turning Hydraulic phop

Component: Hydraulic phop, 27SiMn, HRC55
Selected Insert: BN-S20 CNMN120712
Cutting Condition: \( ap=1\text{mm}, \ Fr=0.15\text{mm/r}, \ Vc=145\text{m/min}, \) dry cutting

<table>
<thead>
<tr>
<th>Insert material</th>
<th>Cutting Speeds</th>
<th>Roughness</th>
<th>Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Halnn BN-S20</td>
<td>145m/min</td>
<td>Ra0.4</td>
<td>Improved 11 times</td>
</tr>
<tr>
<td>Carbide Insert</td>
<td>30m/min</td>
<td>Ra3.2</td>
<td>----</td>
</tr>
</tbody>
</table>

With BN-S20, efficiency improved 11 times

Laser cladding workpiece processing difficulties:
1. High hardness, about above HRC50
2. Complex component, it doesn't have suitable grinding machine
3. Large allowance, it belongs to interrupt turning condition.
BN-S200 milling the mold

Component: Mold
Materials: Cr2MoV, HRC65
Machining Process: Finish turning mold surface
Selected Insert: BN-S200 RNGN090300
Cutting Condition: ap = 0.5mm, Fr = 0.12mm/r, Vc130 = m/min

<table>
<thead>
<tr>
<th>Insert Materials</th>
<th>Cutting Speed Vc</th>
<th>Tool Life</th>
<th>Tool Cost/piece</th>
</tr>
</thead>
<tbody>
<tr>
<td>Halnn BN-S200</td>
<td>130m/min</td>
<td>120 pcs</td>
<td>USD 0.05</td>
</tr>
<tr>
<td>Other PCBN</td>
<td>130m/min</td>
<td>115 pcs</td>
<td>USD 0.08</td>
</tr>
</tbody>
</table>
1. Chipbreaker Insert: Excellent chip breaking performance, to avoid the chip wrapped around the workpiece or tool, to ensure good surface quality and tool life.
2. Wiper PCBN Insert:
   (1) With same feeds, wiper insert can obtain better surface quality
   (2) With same roughness requirements, wiper insert can use larger feeds, which can reduce the time on each component, improve the efficiency.
3. Coating PCBN Insert: The perfect combination of smooth coating and CBN base can achieve better cutting performance and improve machining accuracy and life.
Halnn Superhard, as the pioneer of superhard cutting tools in China, make national Superhard Materials Key Laboratory and Henan University of Science and technology as technical support, have our own research center, focus on **cbn cutting tools and high grade diamond tools for machining brittle and hard materials**, have obvious advantages on most industries, such as **turning instead of grinding, high hardness materials machining, heavy turning, high speed machining**, etc. At the same time, we have launched a series of new cbn/pcd cutting tools and other material tools in 3C, aerospace and Nuclear energy military field, depending on the research center of Henan Superhard Materials Institute. Our customers have covered many countries and areas, including China Mainland, German, Italy, USA, Korea and other areas.
Thanks!

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