superabrasive
CUTTING TOOLS and WEAR PARTS

PRECISELY.

abrasive technology
www.abrasive-tech.com
PCD Cutting Tools

PCD tools are as abrasion resistant as natural diamond tools and are much tougher. The diamond layer consists of diamond particles that are randomly oriented and do not have any cleavage planes or soft wear directions.

PCD tools are recommended to machine non-ferrous and very abrasive materials. They have the capacity to out produce carbide tools 10 to 100 times.

We manufacture PCD tooling for all turning, boring, drilling, milling and reaming applications. Cutting tools and inserts of any make can be tipped with PCD sections.

There are two options:
- We can supply the tool complete.
- We can tip our customers’ new tools or inserts.

Range of Product Line:
PCD sections are available in three grades:
1. Fine: For finishes less than 15 Micro inches (.4 micrometers).
2. Medium: For standard finishes.
3. Coarse: For very abrasive materials.

Recommended Use:
PCD tools offer superior wear resistance. They are recommended on the following materials:
- Metallic: Aluminum, Babbitt, Brass, Bronze & Copper, High Cobalt Sintered Carbide, Magnesium, Pre-sintered Carbide, Zinc Alloys.
- Plastics: Acrylic, Fiberglass Epoxy, Nylon Composites Phenolics, Poly Carbonate, P.V.C. Composites Teflon® Composites

Samples of our Custom-Designed Tools
- We offer brazed tipped cutting tools, boring tools and cut off tools.
- Tools are custom designed by our design engineers, working from a customer supplied drawing.
- Custom tools are quoted on request.

<table>
<thead>
<tr>
<th>Workpiece</th>
<th>Nose Radius (inch)</th>
<th>Clearance Angle (degrees)</th>
<th>Back Rake Angle (degrees)</th>
<th>Speed (SFFPM) (M/min.)</th>
<th>Depth of Cut (inch)</th>
<th>Feed Rate (inch/rev)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminum alloys</td>
<td>0.006” – 0.040”</td>
<td>5 – 10</td>
<td>+ 0 – 10</td>
<td>3000 - 5000</td>
<td>0.005” – 0.020”</td>
<td>0.002” – 0.008”</td>
</tr>
<tr>
<td></td>
<td>0.15 – 1.0mm</td>
<td></td>
<td></td>
<td>914 - 1524</td>
<td>0.13 – 0.51mm</td>
<td>0.051 – 0.20mm</td>
</tr>
<tr>
<td>Copper alloys including bronze</td>
<td>0.010” – 0.040”</td>
<td>5 – 30</td>
<td>+ 10 – 20</td>
<td>1500 - 3500</td>
<td>0.005” – 0.020”</td>
<td>0.001” – 0.006”</td>
</tr>
<tr>
<td></td>
<td>0.25 – 1.0mm</td>
<td></td>
<td></td>
<td>457 - 1067</td>
<td>0.13 – 0.51mm</td>
<td>0.025 – 0.15mm</td>
</tr>
<tr>
<td>Sintered cemented tungsten carbide</td>
<td>0.040” – 0.125”</td>
<td>5 – 12</td>
<td>0</td>
<td>500 - 1500</td>
<td>0.0005” – 0.005”</td>
<td>0.001” – 0.005”</td>
</tr>
<tr>
<td></td>
<td>1.0 – 3.2mm</td>
<td></td>
<td></td>
<td>152 - 457</td>
<td>0.013 – 0.13mm</td>
<td>0.025 – 0.076mm</td>
</tr>
<tr>
<td>Glass fiber/plastic composites</td>
<td>0.030” – 0.090”</td>
<td>5 – 20</td>
<td>+ 0 – 6</td>
<td>400 - 3600</td>
<td>0.001” – 0.003”</td>
<td>0.001” – 0.010”</td>
</tr>
<tr>
<td></td>
<td>0.76 – 2.3mm</td>
<td></td>
<td></td>
<td>122 - 1097</td>
<td>0.025 – 0.076mm</td>
<td>0.025 – 0.25mm</td>
</tr>
<tr>
<td>Carbon/plastic composites</td>
<td>0.020” – 0.040”</td>
<td>5 – 20</td>
<td>+ 0 – 6</td>
<td>500 - 2000</td>
<td>0.010” – 0.100”</td>
<td>0.005” – 0.015”</td>
</tr>
<tr>
<td></td>
<td>0.51 – 1.0mm</td>
<td></td>
<td></td>
<td>152 - 610</td>
<td>0.25 – 2.54mm</td>
<td>0.13 – 0.38mm</td>
</tr>
<tr>
<td>High-alumina ceramics</td>
<td>0.010” – 0.40”</td>
<td>5 – 20</td>
<td>+ 0 – 6</td>
<td>1500 - 3000</td>
<td>0.0005” – 0.005”</td>
<td>0.001” – 0.004”</td>
</tr>
<tr>
<td></td>
<td>0.25 – 1.0mm</td>
<td></td>
<td></td>
<td>457 - 914</td>
<td>0.013 – 0.13mm</td>
<td>0.025 – 0.10mm</td>
</tr>
</tbody>
</table>

STARTING PARAMETERS FOR PCD TOOLS
Innovation delivers a unique PCD drill

We have successfully developed the solution to the manufacturing and engineering industries’ need to apply PCD (polycrystalline diamond) technology to today’s machining challenges.

Existing products exhibit short life, failing fabrication joints, and a lack of a rugged cutting edge. Our patented design of a PCD section, fully integrated into the carbide drill, has overcome these problems.

The benefits of machining non-ferrous materials with PCD are well established. Applying PCD technology to the drilling process has long been an objective for many companies.

While electroplated, CVD coated or fabricated drills have failed to meet the expectations and technical challenges of modern machining, the Everlast™ drill meets and exceeds those expectations.

Specifications:
- Available in 1/8” (3mm) and 15/32” (12mm) diameters.
- Standard lengths up to 8” (200mm), others by application.
- Helical flute.
- Straight flute.
- Made to customers’ specifications.

Advantages:
- Vastly improved drill life (the drill is not a fabrication).
- Improved drill hole surface finish.
- Greater tolerance control.
- Greatly reduced downtime due to fewer drill changeovers and quality checks.
- Rugged construction enables the Everlast™ drill to handle difficult conditions that damage other drills beyond use.
- Faster drill speeds and feeds.
- Designed for many current composite and aerospace materials such as Kevlar® and CFC.
- Designed for very high silica aluminum.
- Sharper cutting

Designed for use on:
- Very high Silica Aluminum
- Carbon Fiber Reinforced Plastics (C.F.R.P.)
- Reinforced Ceramic Composites (RCC)
- Carbon Fiber/Aluminum stack material (C.F.R.P./AL)
- Metal Matrix Composites (M.M.C.)
- Green Carbide
PCD Combination Tooling

Designed to meet our customers’ specific applications. For machining non-ferrous materials, including high silica aluminum and other exotic materials.

- Combines several tool operations in one pass.
- Diamond cutting edge = high precision.
- Long life = reduced downtime.
- Reduced number of machining stations.
- Reduced tooling stock holding.
- Tamperproof tooling.
- High component consistency.

CASE STUDIES

**Tool Function:** Drill and Form  
**Product being machined:** High pressure aluminum housing  
**Surface speed:** 2,100 ft./min. (650m/min.)  
**Stock Removal:** .236” - .315” (6-8mm) on top recess face  
**Feed Rate:** 120 IPM (3000mm/min.)  
**Surface Finish achieved:** 0.7Ra  
**Fitting Standard:** ISO40  
**Number of forming Operations:** 7  
**Benefits:**  
- Increase production capacity by 60-70% due to the ability to perform 2 functions in one pass.  
- Reduced machine downtime.  
- Reduced machine changeover time.

**Tool Function:** Size and Form  
**Product being machined:** High pressure aluminum housing  
**Surface speed:** 1,500 ft./min. (450m/min.)  
**Stock Removal:** .02” (0.5mm)  
**Feed Rate:** 6 IPM (150mm/min.)  
**Surface Finish Achieved:** 0.4Ra  
**Fitting standard:** MK3  
**Number of Forming Operations:** 15  
**Benefits:**  
- Ability to achieve a very high level of surface finish which eliminates the burnishing operation.  
- Reduced machine downtime.  
- Reduced machine changeover time.

**Tool Function:** Reaming  
**Product being machined:** Spark plug ports  
**Surface Speed:** 160 ft./min. (50m/min.)  
**Stock Removal:** .024” (0.6mm)  
**Feed Rate:** 0.008”/Revolution (0.2mm/Revolution)  
**Surface Finish Achieved:** 0.2Ra  
**Fitting standard:** Steiber Chuck  
**Number of Forming Operations:** 8  
**Benefits:**  
- Number of pieces being machined now with this tool: 250,000.  
- Number of pieces being machined with previously used carbide tools: 15,000.  
- Reduced machine downtime.  
- Reduced machine changeover time.
High Performance PCD Tipped Inserts

For rough and finish machining of non-ferrous and non-metallic parts

- Longer PCD edge lengths allow larger depths of cut, reducing the number of passes - resulting in shorter cycle time and increased productivity.
- Large PCD sections provide more holding power - resulting in more re-laps and fewer tip pull offs.
- Polished PCD tops for keener edges and better chip flow.
- Can be used to machine aluminum in both neutral and negative holders.
- Edges ground on CNC equipment for consistency and quality finishes.
- All inserts are manufactured to the latest ISO standard for assured quality.

PCD Wear Parts

The life of PCD components is typically 100 times that of the carbide or HSS predecessor. The low friction coefficient of PCD, together with its ultra hardness, ensures that high levels of component accuracy are maintained over the component’s life span.

PCD wear surfaces are used for:
- Vee Supports
- Backing Plates
- Gauging Fingers
- Gauging Points
- Back Stops
- Face Grinding
- PCD Rings

Advantages:
- Reduced whole life costs.
- Reduced downtime.
- Reduced changeover rates.
- Increased component accuracy.
PCBN CUTTING TOOLS

AbrasivesTechnology features PCBN tools for all turning, boring and milling applications. We offer two groups:

- BRAZED TIPPED PCBN tools and inserts.
- SOLID inserts with PCBN in a ceramic binder throughout the insert, or a full face 1/32” (.787mm) thick layer on a carbide substrate.

Physical Properties

The hardness of PCBN falls between diamond and carbide. It is considerably more abrasion resistant than both carbide and ceramic cutting tools. PCBN combines a high degree of toughness and hot hardness. These properties make it particularly suited to machine hardened steels, cast irons and super alloys.

Grades

PCBN is available in several grades, each having specific properties and usage. There are two basic categories:

- Low content CBN grain primarily designed for finishing cuts on hardened steel.
- High content CBN grain designed for machining cast iron, hard facing material and Nickel alloys.

Insert Designations

Our polycrystalline inserts use the ANSI/ISO standard to identify indexable inserts.

We also offer brazed tipped “shank” cutting tools, boring tools and cut-off tools. These are usually specified by print.

Standard PCBN Tool Examples

- Solid PCBN Insert
- PCBN Insert
- Full Face Insert
- Valve Seat Tools
- PCBN Boring Tool

## STEEL Grade Comparison Chart - Polycrystalline Cubic Boron Nitride (PCBN)

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
<th>Features</th>
<th>Materials</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLA</td>
<td>Low PCBN Content</td>
<td>Long Tool Life</td>
<td>Hardened Steels, Gray Cast Irons, Die Steels, Bearing Steels</td>
<td>Light Continuous Cuts</td>
</tr>
<tr>
<td>CLB</td>
<td>Low PCBN Content</td>
<td>Long Tool Life</td>
<td>Alloy Steels, Die Steels, hardened Steel</td>
<td>Continuous Cuts to Light Interrupted Cuts</td>
</tr>
<tr>
<td>CL</td>
<td>Low PCBN Content</td>
<td>Good Balance Between Tool Life and Shock Resistance</td>
<td>Hardened Steels, Cast Irons, Powdered Metals, Tool Steels</td>
<td>Moderate Interrupted Cuts</td>
</tr>
<tr>
<td>CHA</td>
<td>High PCBN Content</td>
<td>Excellent Wear and Fracture Resistance in Severe Interrupted Cuts</td>
<td>Ni-Hard, High Chrome Alloys, Cast Irons, Sintered Irons</td>
<td>Severe Interrupted Cuts, Heavy Stock Removal</td>
</tr>
<tr>
<td>CHB</td>
<td>High PCBN Content</td>
<td>Excellent Wear and Fracture Resistance in Severe Interrupted Cuts</td>
<td>Ni-Hard, Chilled Irons, Gray Cast Irons</td>
<td>Severe Interrupted Cuts, Heavy Stock Removal</td>
</tr>
<tr>
<td>CHC</td>
<td>High PCBN Content</td>
<td>Excellent Toughness and Abrasion Resistance</td>
<td>Gray Cast Irons, Super Alloys, Nickel Alloys, Sintered Ferrous Metals</td>
<td>Severe Interrupted Cuts, Heavy Stock Removal</td>
</tr>
<tr>
<td>CH</td>
<td>High PCBN Content</td>
<td>Excellent Toughness and Abrasion Resistance</td>
<td>Gray Cast Irons, Super Alloys, Nickel Alloys, Sintered Ferrous Metals</td>
<td>Moderate Interrupted Cuts</td>
</tr>
</tbody>
</table>

### Machining Parameters for CBN Turning/Boring Tools

<table>
<thead>
<tr>
<th>Material Hardness</th>
<th>HRC</th>
<th>Stock Removal</th>
<th>Feed</th>
<th>Finishing Cuts -1.0mm</th>
<th>Feed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cold Work Tool Steels</td>
<td>60</td>
<td>197–394</td>
<td>60–120</td>
<td>.002–.01</td>
<td>0.05–0.25</td>
</tr>
<tr>
<td>High Speed Steels</td>
<td>62</td>
<td>131–282</td>
<td>40–80</td>
<td>.002–.01</td>
<td>0.05–0.25</td>
</tr>
<tr>
<td>Ni Hard White Irons</td>
<td>55–68</td>
<td>164–265</td>
<td>50–800</td>
<td>.004–.012</td>
<td>0.1–0.3</td>
</tr>
<tr>
<td>Gray Cast Irons</td>
<td>220HR</td>
<td>1,640–2,625</td>
<td>500–800</td>
<td>.004–.012</td>
<td>0.1–0.3</td>
</tr>
<tr>
<td>Bearing Steels</td>
<td>58–60</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Hard Facing Cobalt Alloys</td>
<td>–</td>
<td>656–820</td>
<td>200–250</td>
<td>.008</td>
<td>0.2</td>
</tr>
<tr>
<td>Hard Facing Nickel Alloys</td>
<td>–</td>
<td>394–492</td>
<td>120–150</td>
<td>.008</td>
<td>0.2</td>
</tr>
<tr>
<td>Surface Hardened Parts</td>
<td>55–58</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>
PCD/PCBN Tipped Cutting Tools - Tool Service

We offer two types of service:

Class 1 - Relap
The tools are contour ground. However the IC/Tool geometry is reduced. If it is essential that the tool geometry remains unchanged, a class 2-3 service can be done.

Class 2 - Retip
The PCD/PCBN material is replaced and reground to the original tool geometry.

Product Design Engineering Services
Rapid manufacture of bespoke special cutting tools is at the core of our business and these can be designed and quoted on request. Please refer to the drawings in this catalog as an aid in communicating your request for quote. Also, the following information is required to best determine your needs:

1. Part drawing indicating the position of the tool and the direction of tool travel.
2. Type of equipment and maximum feeds and speeds available.
3. Maximum depth of cut. The size of the polycrystalline diamond section will influence the price of the product. It is therefore important that the maximum depth of cut be specified when a tool is ordered. This determines the CEL (cutting edge length) desired for maximum effectiveness.
4. Material to be machined and Rockwell hardness (if ferrous metals are involved).
5. The objective of this design:
   • Increase in tool life.
   • Better surface finish.
   • Minimize chipping.
6. Drawing or description of tools presently used or insert designation.
7. Identify the carbide fabricator for special inserts.

Edge Preparation
‘T’/‘K’ Lands or honed edges can be applied to PCBN tools as required.