KYOCERA

A Solution to Rising Carbide Tool Costs

A Practical Guide to Using Cermet

Cutting performance and application guidelines for continuous, light-interrupted, and interrupted machining

As carbide prices continue to rise, cermet is gaining attention as a way to reduce tooling costs and reliance on carbide.

Can Cermet Be Used for Interrupted Machining? How Do You Select the Right Tool?

To answer these questions, Kyocera evaluated the cutting performance of cermet.
Based on the results, this guide outlines the key considerations for selecting and using cermet effectively.

The data presented in this brochure is based on Kyocera's internal evaluations and does not guarantee the performance of cermet in all machining environments.

Cermet Overview

What is Cermet?

The term "cermet" combines the words "ceramic" and "metal."

Cermet is characterized by greater hardness than cemented carbide.

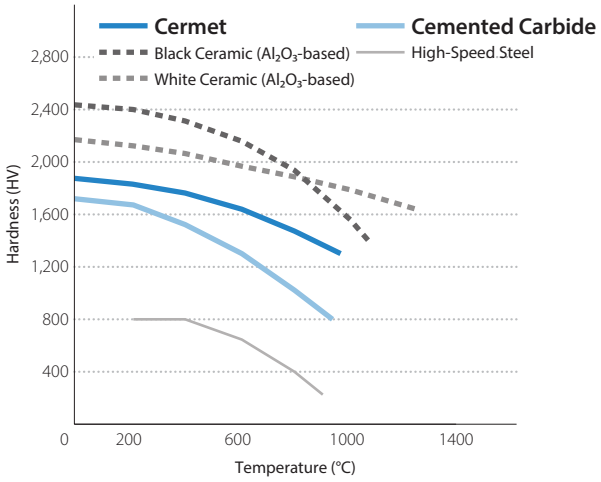
While cemented carbide consists primarily of tungsten carbide (WC), cermet consists primarily of titanium-based carbides and nitrides. Because it is less affected by rising tungsten prices, cermet is attracting attention as an alternative to carbide tooling.

Material Properties and Benefits of Cermet

High Hot Hardness

Compared with cemented carbide, cermet maintains greater hardness at elevated temperatures.

Its excellent resistance to flank wear and crater wear enables higher cutting speeds than carbide inserts.



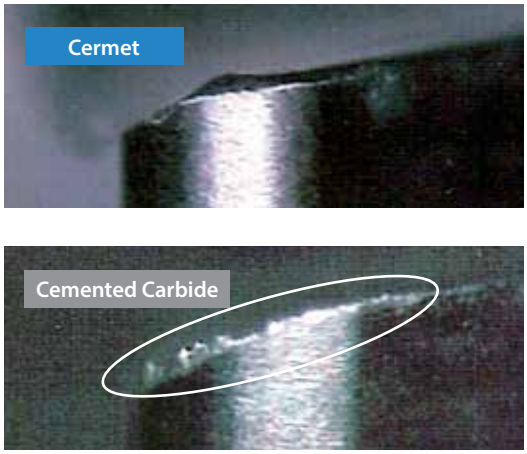
Hot Hardness Comparison

Low Chemical Affinity with Iron (Fe)

Cermet has a low chemical affinity with iron (Fe) in the workpiece material.

As a result, built-up edge is less likely to occur, helping produce an excellent surface finish.

Cutting Edge Condition Comparison (Internal Evaluation)



Excels in Finishing

Cermet is particularly well suited for finishing operations.
Compared with roughing, finishing typically involves the following conditions:

Small depths of cut and low cutting loads

High cutting speeds

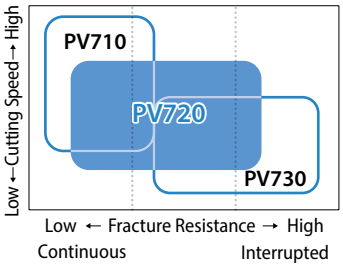
Under these conditions, cermet's material properties enable stable machining, long tool life, and high-quality surface finishes.

Kyocera Cermet Grades

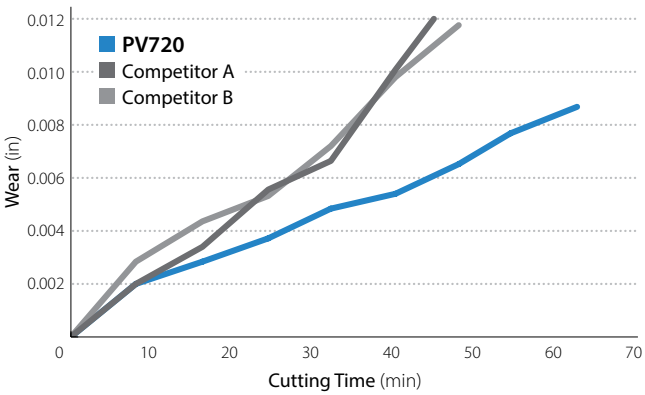
General Purpose

PV720

Excellent wear resistance for high-efficiency machining and high-quality surface finish

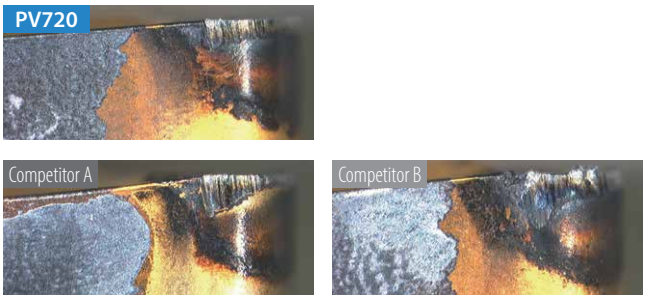


Wear Resistance Comparison (Internal Evaluation)



Cutting Conditions: Vc = 820 sfm, ap = 0.039", f = 0.008 ipr, Wet, CNMG432 type Workpiece: 4137

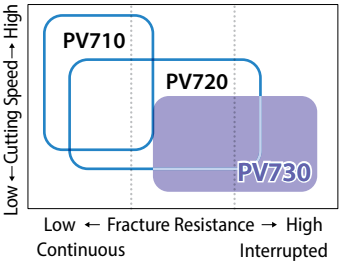
Cutting Time: after 48 minutes



Stability Focused

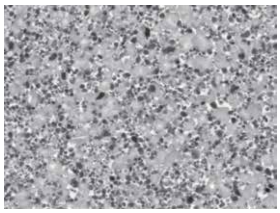
PV730

KYOCERA's toughest cermet delivers high stability and a high-quality surface finish

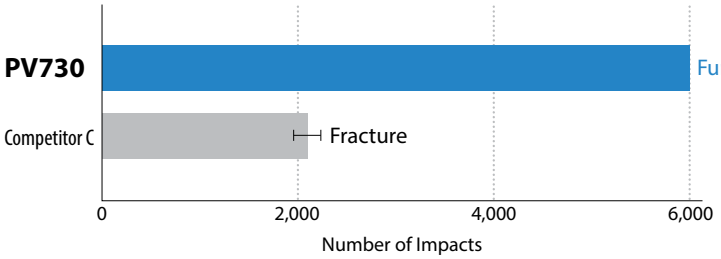


Tough Micrograin Cermet Improves Fracture Resistance While Maintaining Surface Finish and Wear Resistance

Tough Cermet Technology



Fracture Resistance Comparison (Internal Evaluation)



Cutting Conditions: Vc = 590 sfm
ap = 0.020", f = 0.010 ipr, Wet
CNMG432 Type
Workpiece: 1045 (4 grooves), n = 3

Chipbreakers Suitable for Finishing

For Finishing

PP Chipbreaker

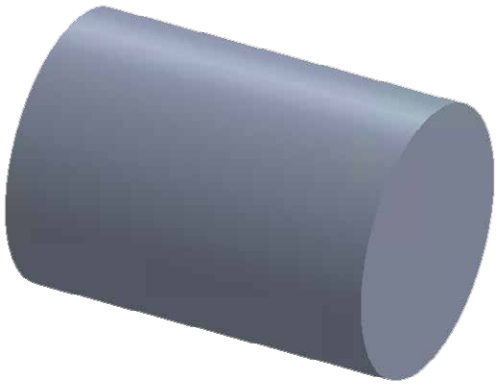
Low cutting forces and excellent sharpness

For Finishing - Medium

PQ Chipbreaker

Balances sharpness and edge strength

PV720 Matches or Exceeds Carbide Tool Life with Excellent Surface Finish



- ✓ **Excellent wear resistance even in high-speed finishing at Vc = 980 sfm**
- ✓ **Limits diameter growth while maintaining an excellent surface finish**

In continuous finishing, wear-resistant **PV720** delivers tool life equal to or greater than carbide grades while maintaining an excellent surface finish, helping reduce tooling costs when replacing carbide inserts.

Cutting Performance Comparison (Internal Evaluation)

4115 Steel Ø4.646" × 4.646" L

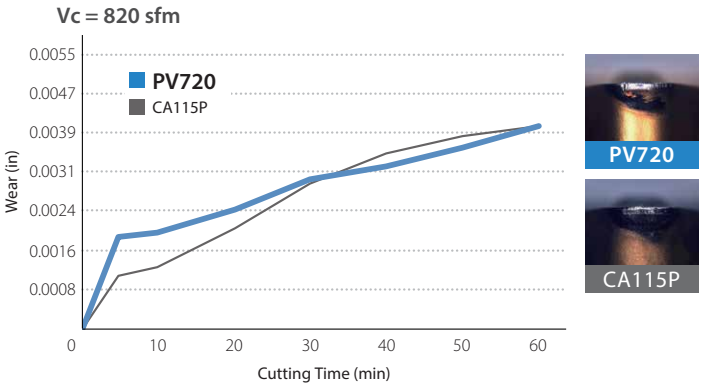
Vc = 820–980 sfm, ap = 0.020", f = 0.006 ipr, Wet

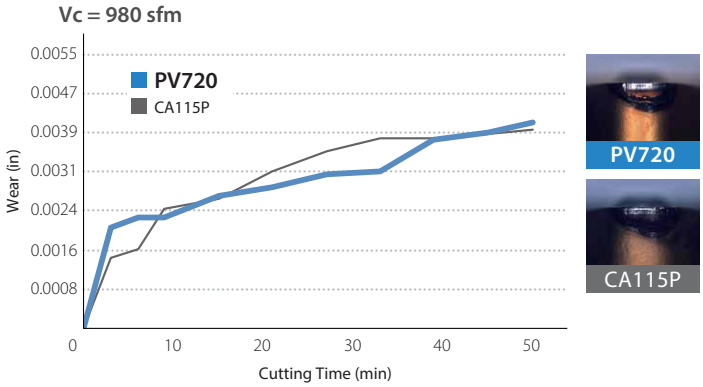
CNMG4 Type

Grade	Chipbreaker	Corner Radius
CA115P (CVD Carbide)	PP	1/32"
PV720 (PVD Cermet)	PP	1/32"

Wear Resistance

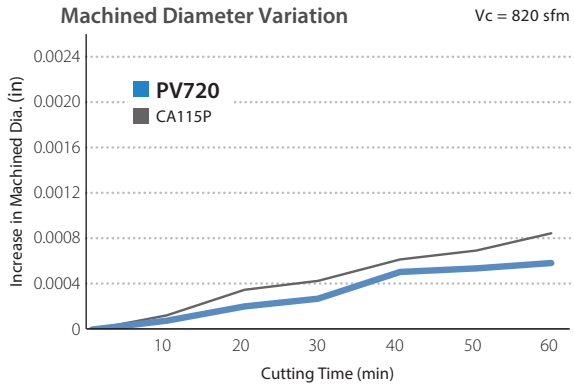
Excellent wear resistance even under high-speed finishing conditions

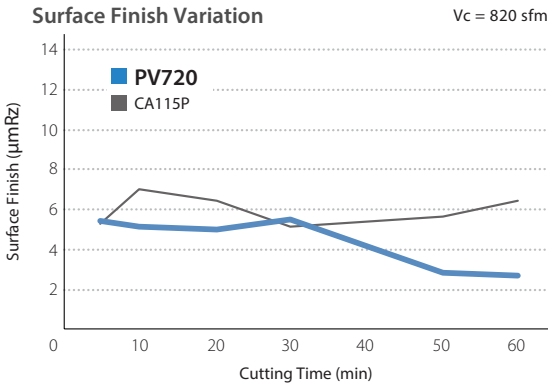




Machining Quality

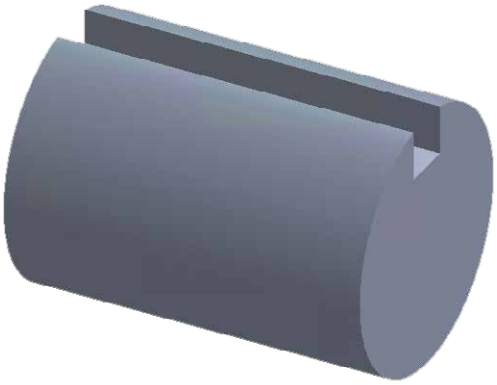
Excellent dimensional accuracy and surface finish





Cutting Data 2 : Light Interrupted Machining

PV730 with PQ Chipbreaker Delivers Stable Machining



- ✓ **Lowering the feed rate provides even greater machining stability**
- ✓ **Select the PP chipbreaker when sharpness is the priority**

For light interrupted machining, tough **PV730** cermet combined with the **PQ** chipbreaker provides stable performance with wear resistance approaching that of carbide grades.

Cutting Performance Comparison (Internal Evaluation)

1045 Steel Ø2.677" × 4.646" L, 1 groove

Vc = 820 sfm, ap = 0.020", f = 0.004–0.006 ipr, Wet

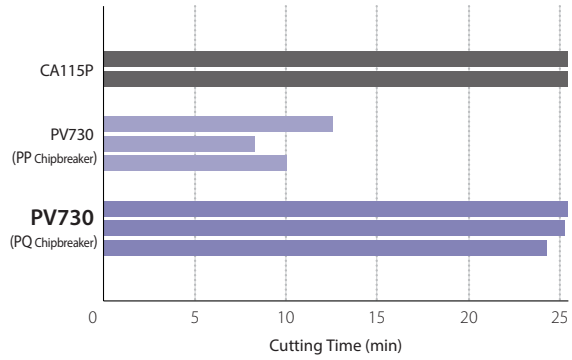
CNMG4 Type

Grade	Chipbreaker	Corner Radius
CA115P (CVD Carbide)	PP	1/32"
PV730 (PVD Cermet)	PP	1/32"
PV730 (PVD Cermet)	**PQ**	1/32"

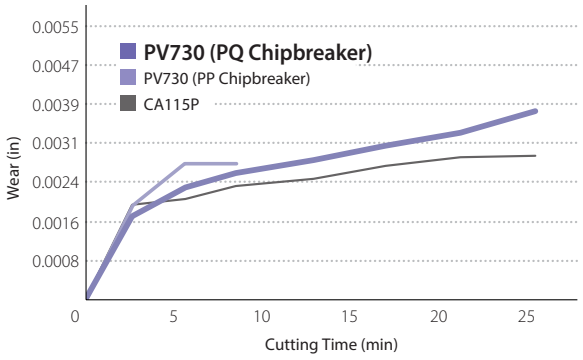
Fracture Resistance

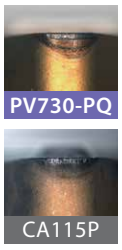
Wear Resistance

f = 0.006 ipr

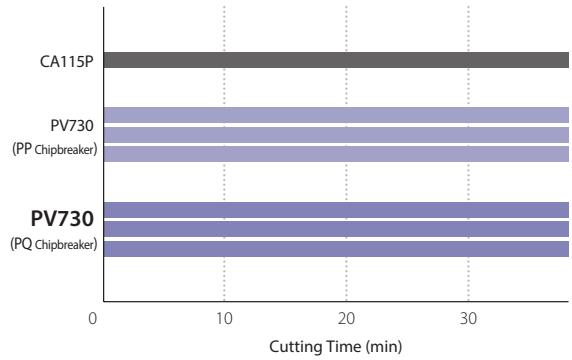


*Total Number of Impacts : 37,476

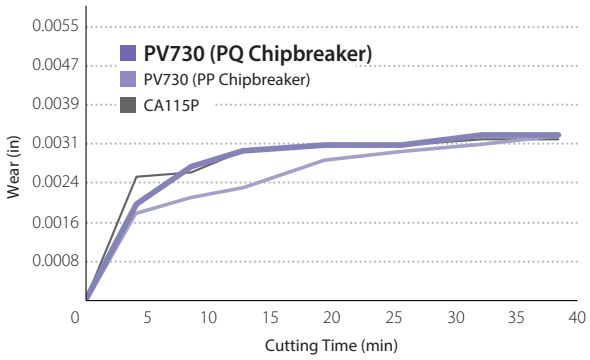




f = 0.004 ipr



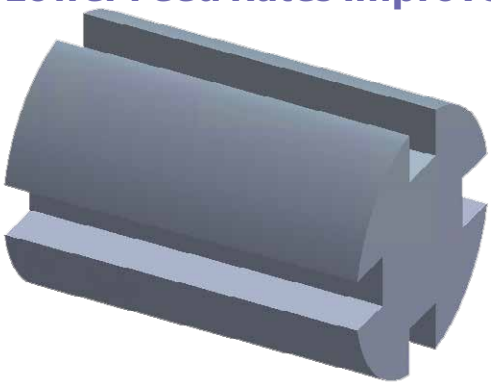
*Total Number of Impacts : 56,214



*Both tests were conducted to the same chip-removal volume: total volume = 29.2 in³

Cutting Data 3 : Interrupted Machining

PV730 Recommended for Interrupted Machining
Lower Feed Rates Improve Stability



Cutting Performance Comparison (Internal Evaluation)

- ✓ **For stable cermet machining, reduce the feed rate to approximately f = 0.004 ipr**
- ✓ **A larger corner radius can help maintain stable machining without reducing the feed rate**

Tough **PV730** cermet is recommended for interrupted machining, with lower feed rates providing fracture and wear resistance approaching carbide levels.

1045 Steel Ø2.677" × 4.646" L, 4 grooves

Vc = 820 sfm, ap = 0.020", f = 0.004–0.006 ipr, Wet

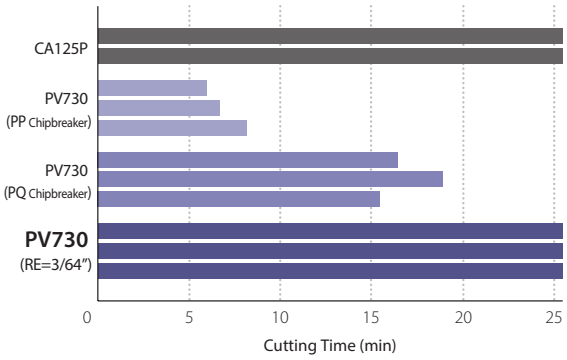
CNMG4 Type

Grade	Chipbreaker	Corner Radius
CA125P (CVD Carbide)	PP	1/32"
PV730 (PVD Cermet)	PP	1/32"
PV730 (PVD Cermet)	**PQ**	1/32"
PV730 (PVD Cermet)	PP	**3/64"**

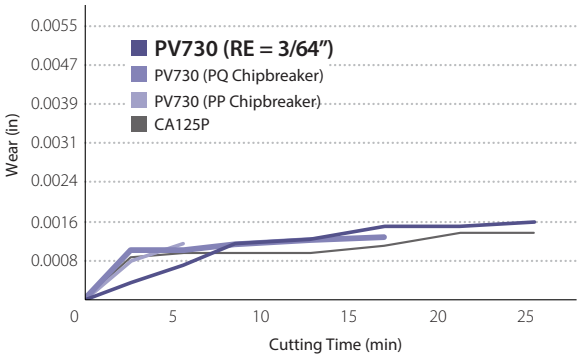
Fracture Resistance

Wear Resistance

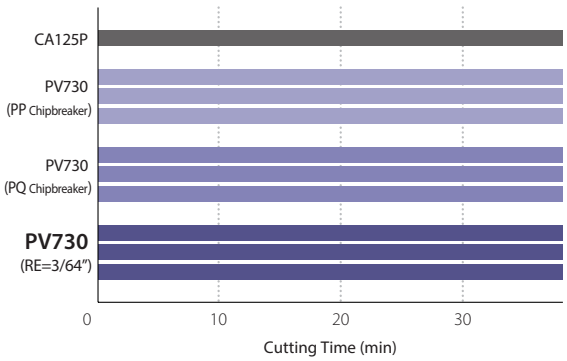
f = 0.006 ipr



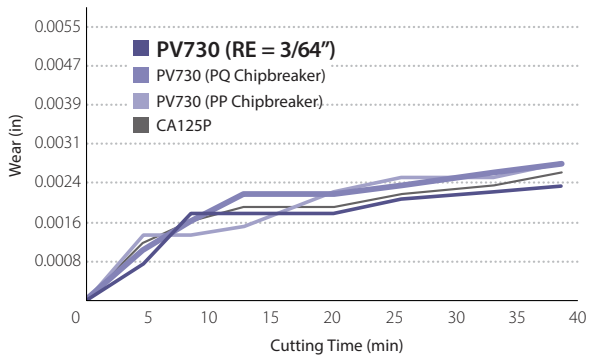
*Total Number of Impacts : 149,904



f = 0.004 ipr



*Total Number of Impacts : 224,856



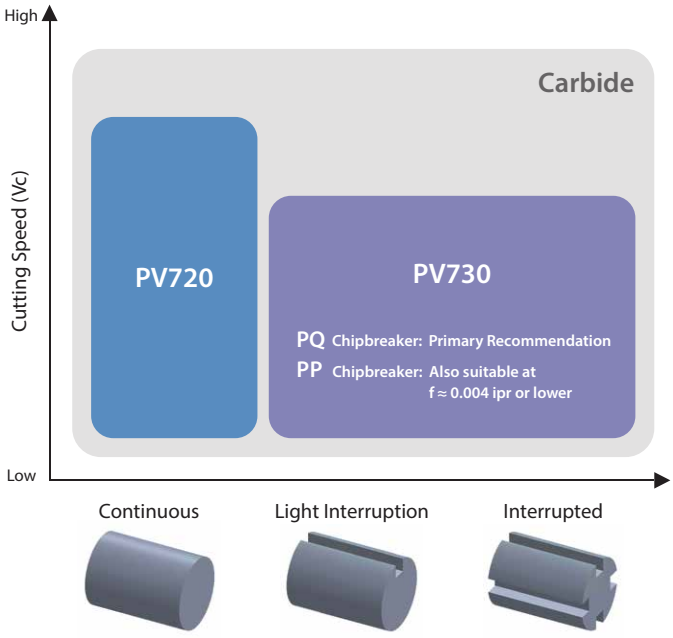
*Both tests were conducted to the same chip-removal volume: total volume = 29.2 in³

Practical Tips for Using Cermet

Cermet Recommendations For Medium-Carbon and Alloy Steels

Recommended Cermet Application Range

Steel Finishing: Vc = ~980 sfm, f = ~0.006 ipr, ap ~0.020", PP Chipbreaker



Continuous **PV720**

Excellent wear resistance and long tool life in high-speed finishing up to Vc = 980 sfm

Light Interrupted **PV730 + PQ Chipbreaker**

PV730 with the PQ chipbreaker is the primary recommendation for stable machining. At lower feed rates, the PP chipbreaker can also provide stable performance.

Interrupted **PV730 + PQ Chipbreaker**

PQ is the primary chipbreaker recommendation for interrupted machining. At lower feed rates of approximately f = 0.004 ipr or less, the PP chipbreaker can also provide stable machining.

Key Considerations for Light to Moderate Interrupted Cutting

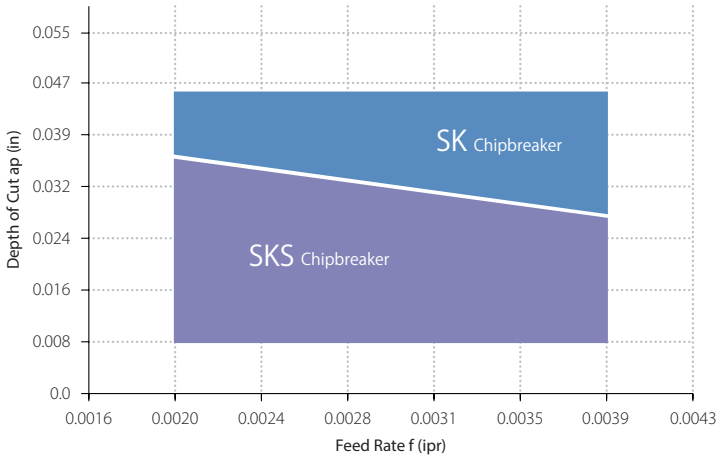
1. The PQ chipbreaker as the primary choice for interrupted machining. At approximately f = 0.004 ipr or lower, the PP chipbreaker is also suitable.
2. Increasing the corner radius to RE = 3/64" can further extend tool life.

Cermet is not recommended for removing scale. Use carbide instead.

Chipbreakers for Small-Part Swiss-Type Machines

Recommended Cermet Application Range

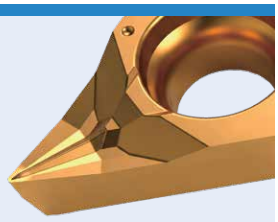
Steel Machining: Vc = 390 sfm



If chip control is unstable at small depths of cut, increase the feed rate.

SK Chipbreaker
General Purpose

Covers a wide range of applications



SKS Chipbreaker
Chip Control Focused

Excellent chip control at small depths of cut

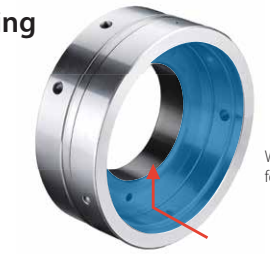
Case Studies Switching from Carbide to Cermet

Study 1

Hub – ID Machining

1045

Vc = 890 sfm
ap = 0.008"
f = 0.006 ipr
Wet
ZBMT13T304GF PV720



Workpiece model shown for reference only

Tool Life Comparison

		Tool Life
PV720 (PVD Cermet)	**80** pcs/edge	4x
Competitor (CVD Carbide)	20 pcs/edge	

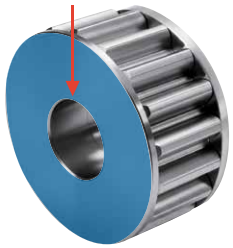
(User Evaluation)

Study 2

Gear – Facing

Alloy Steel

Vc = 660 sfm
ap = 0.010"
f = 0.008 ipr
Wet
CNMG431XF PV720



Workpiece model shown for reference only

Tool Life Comparison

		Tool Life
PV720 (PVD Cermet)	**420** pcs/edge	2.1x
Competitor (CVD Carbide)	200 pcs/edge	

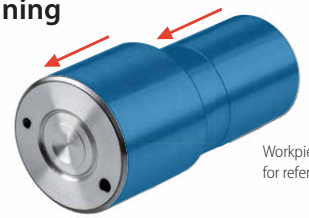
(User Evaluation)

Study 3

Shaft – OD Machining

1045

Vc = 490 sfm
ap = 0.039"
f = 0.008 ipr
Wet
DCMT3252PP PV720



Workpiece model shown for reference only

Tool Life Comparison

		Tool Life
PV720 (PVD Cermet)	**400** pcs/edge	1.3x
Competitor (PVD Carbide)	300 pcs/edge	

(User Evaluation)

Study 4

Ring – ID Machining

1045

Vc = 430 sfm
ap = 0.039"
f = 0.006 ipr
Wet
TPMT221HQ PV730

Workpiece model shown for reference only

Tool Life Comparison

		Tool Life
PV730 (PVD Cermet)	**165** pcs/edge	1.4x
Competitor (CVD Carbide)	120 pcs/edge	

(User Evaluation)

KYOCERA

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