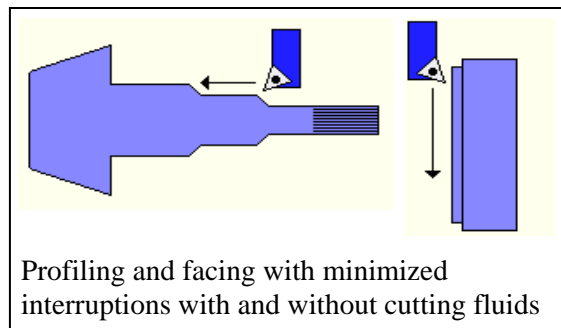


## TuffTek® HT100 Coating on Carbide Inserts for Finish Hard Turning Applications with Minimized Interruptions—Case Studies

TuffTek® HT100 is a composite coating made from cubic boron nitride (cBN) particles and titanium nitride (TiN) or titanium carbonitride matrix (TiCN)\*, and suitable for semi-finish and finish continuous turning applications such as hardened steels up to 53HRC. It can also be used for roughing turning of prehardened steels with minimized interruptions. It has a hardness of about 3000 Hv, and a unique combination of ability to work at high material removal rate, super surface finish, and predictability. The coating can be applied to tungsten carbide inserts of many types, including those with chip breakers. Typical coating thickness at the cutting edge is about 15~18 µm. [\*Specially designed product matrix could be materials such as TiC, HfN, etc.]

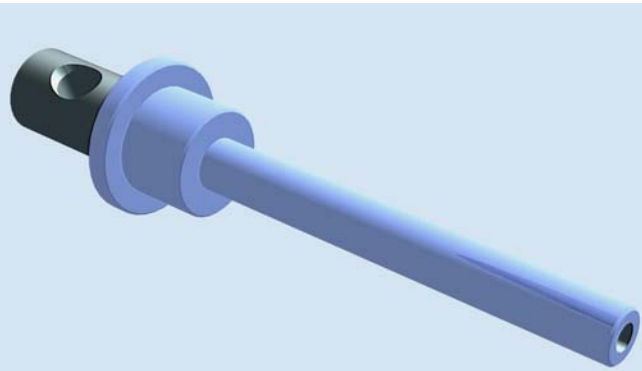
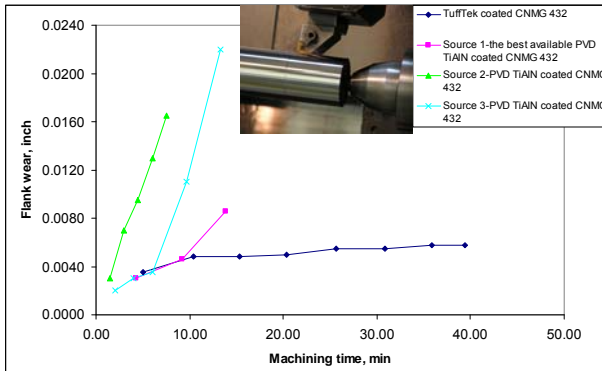
Insert Substrate: CNMA 432 and CNMG432, premium C2 grade or equivalent.

Workpieces and Typical Machining Operations: alloy steels (AISI 4140, 4150, 4340, and 8740), and H13 steel with hardness in the range of 40-53 HRC.



Benchmark Inserts: PVD TiAlN coating coated CNMA432 (major cutting tool manufacturers and coating service providers), Al<sub>2</sub>O<sub>3</sub> bulk insert, CVD multiple layer coating coated CNMA432 (major tool manufacturers), and PCBN inserts (leading supplier)

**Success Stories—Reduced cycle time and improved surface finish**

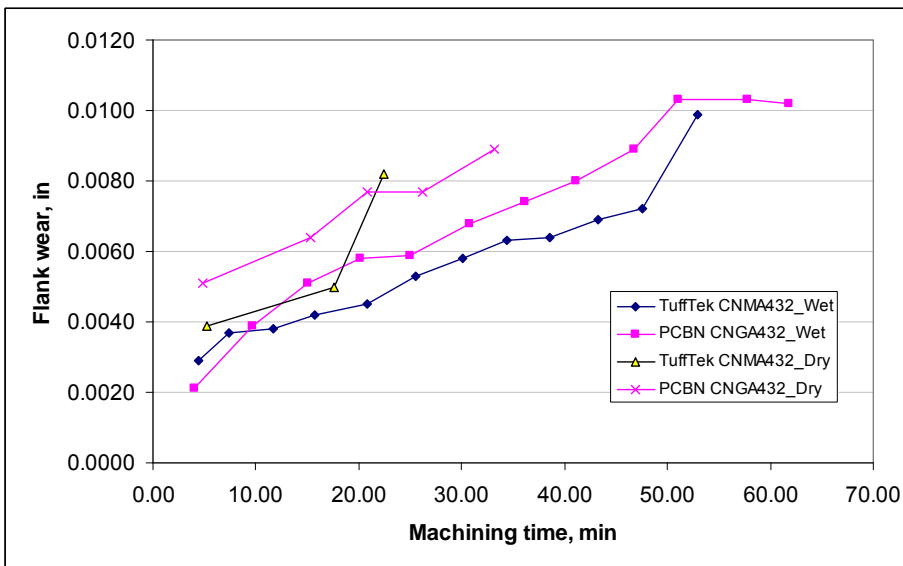


Straight profiling of AISI 4340 with Rc up to 53: V=150m/min, F=0.15 mm/rev, DoC=0.25mm, with cutting fluid.

Semi-finishing A2 steel (58 Rc): V=91m/min, F=0.1 mm/rev, DoC=0.35mm, with cutting fluid

Result: at identical machining conditions and same substrate, TuffTek outperformed PVD TiAlN coated inserts by 300%

Result: at identical machining conditions and same substrate, TuffTek produced 9 pieces; PVD coated inserts produced 3 pieces in average.



Straight profiling of AISI 4340 with Rc up to 53 with and without cutting fluid: V=150m/min, F=0.15 mm/rev, DoC=0.25mm

Result: at identical machining conditions and same geometry, TuffTek coating produced similar tool life to PCBN with cutting fluids; at dry condition, TuffTek produced about 70~75% of tool life of PCBN.

**Application Areas:** first choice for continuous finish turning shafting, wheel face, and other components with hardness up to 53 Rc at wet and dry condition.



# New Product for Release: TuffTek® Coated Inserts for Turning A2 Steel

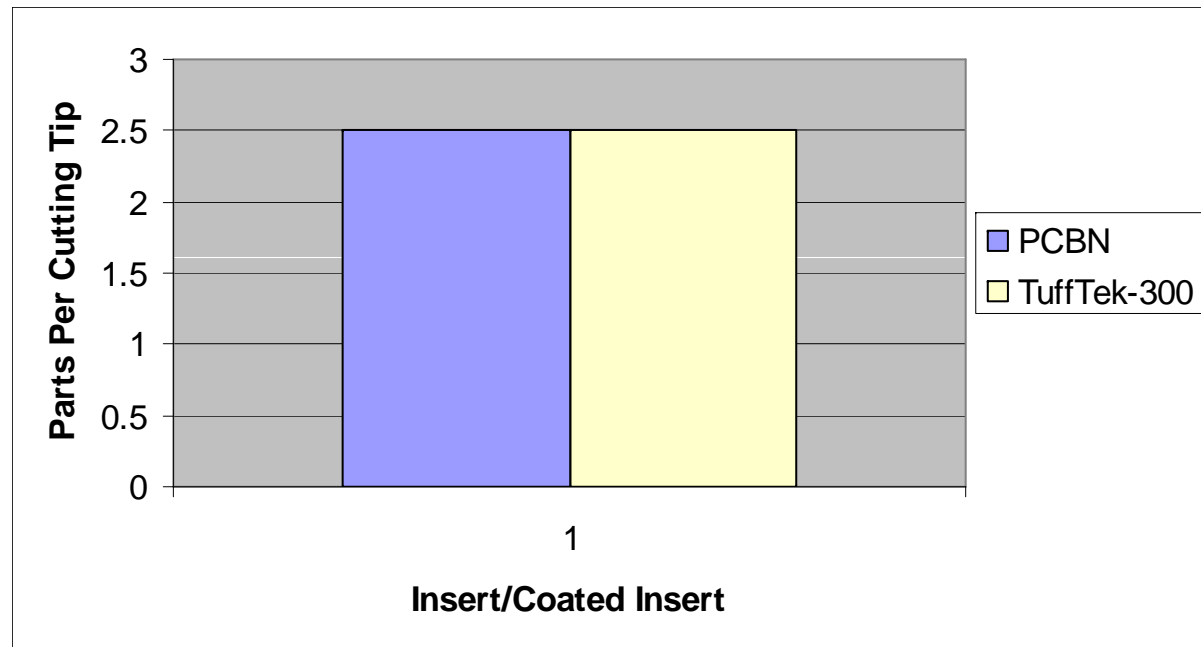
**March, 2011**

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(Patented Process)

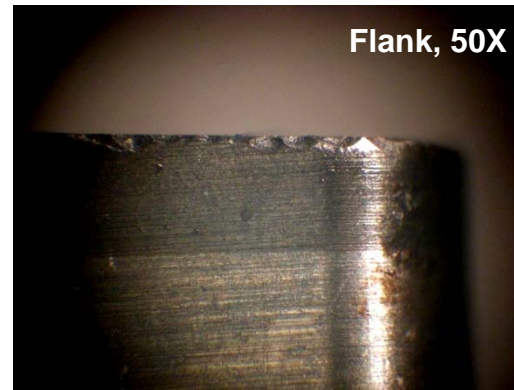
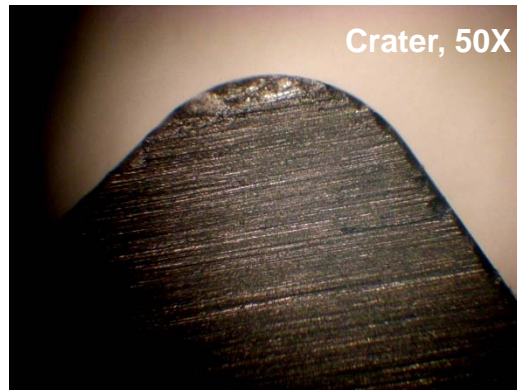


# Comparison of Tool Performance with PCBN Tipped Inserts

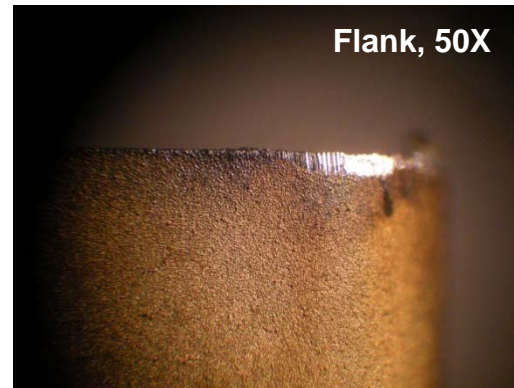


Machining conditions:  $V=300$  SFM,  $F=0.004$  IPM, and  $DOC=0.005$ " without cutting fluid. In average, TuffTek coated inserts produced equivalent parts to PCBN inserts at identical conditions. It can save about \$40/insert (based on current 4 –tip PCBN inserts) without sacrificing productivity.

# Performance Comparison (Continued)



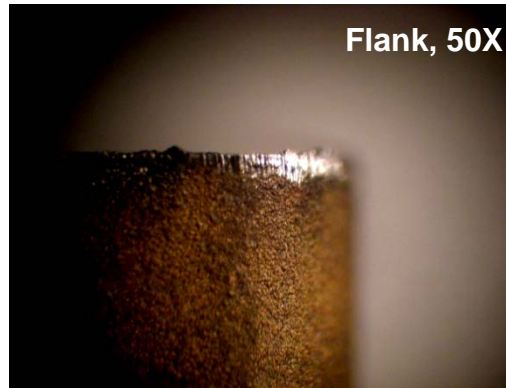
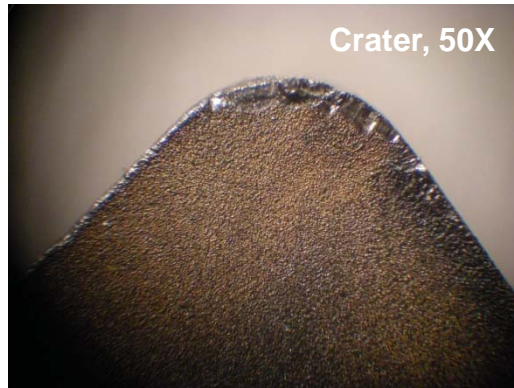
Typical tool wear of **benchmark insert** after producing in average **2~3** parts (55~58 HRC) at V=100~400 SFM, F=0.003/0.005 IPM, and DOC=0.005" without cutting fluid.



Typical tool wear of **TuffTek<sup>®</sup> coated insert (20101124)** after producing in average **3** parts (58~61 HRC) at V=300 SFM, F=0.004 IPM, and DOC=0.005" without cutting fluid. Surface finish is equivalent to that from benchmark insert.

# Performance Comparison (continued)

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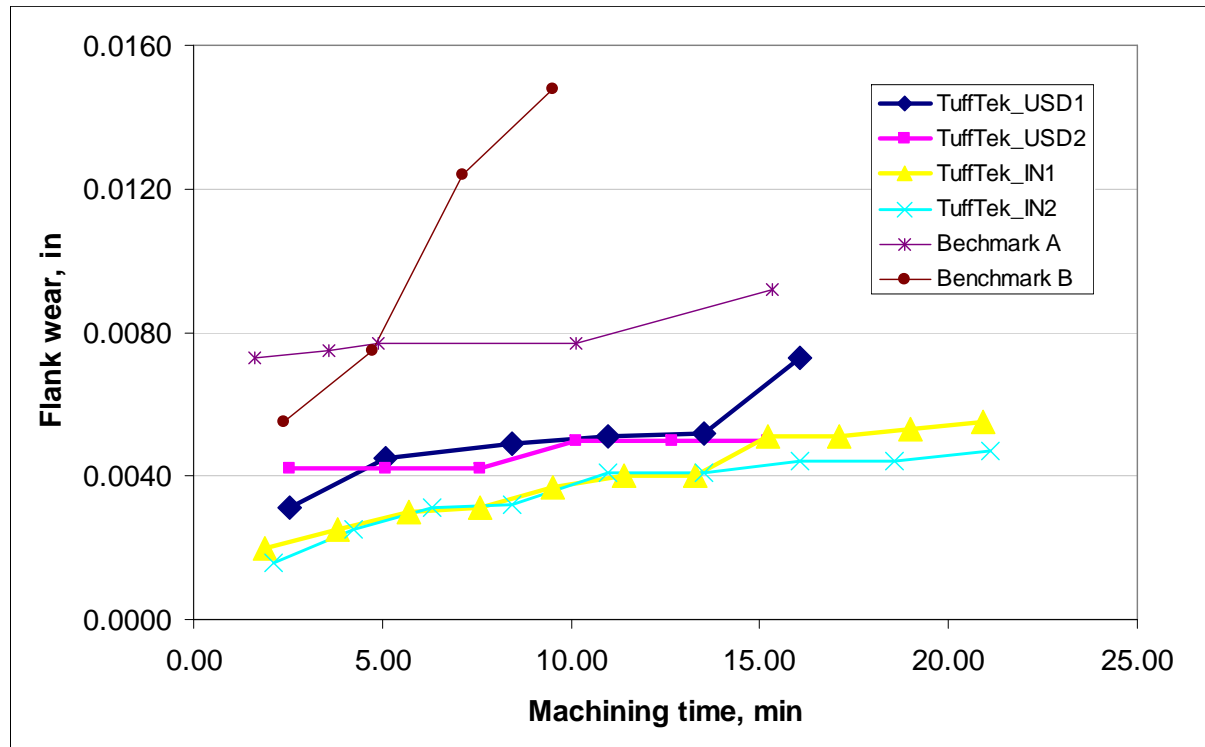
Typical tool wear of **TuffTek® coated insert (20110211)** after producing in average **3** parts (58~61 HRC) at V=300 SFM, F=0.004 IPM, and DOC=0.005" without cutting fluid. Surface finish is equivalent to that from benchmark insert.

## Summary

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- In average, TuffTek coated inserts produce equivalent number of parts per tip in comparison to PCBN tipped inserts;
- Saving \$\$\$ without sacrificing productivity.

# New Development: TuffTek<sup>®</sup> Coated Inserts for Machining with Interruptions (4340 with Hardness up to 54 HRC)



**Workpiece: 4340 hardened (up to 54 HRC) steel bar with a 3/8" slot**  
**Operation: facing**  
**Surface speed: 75 m/min;**  
**Feedrate: 0.1 mm/rev;**  
**Depth of cut: 0.2 mm**  
**With cutting fluid**

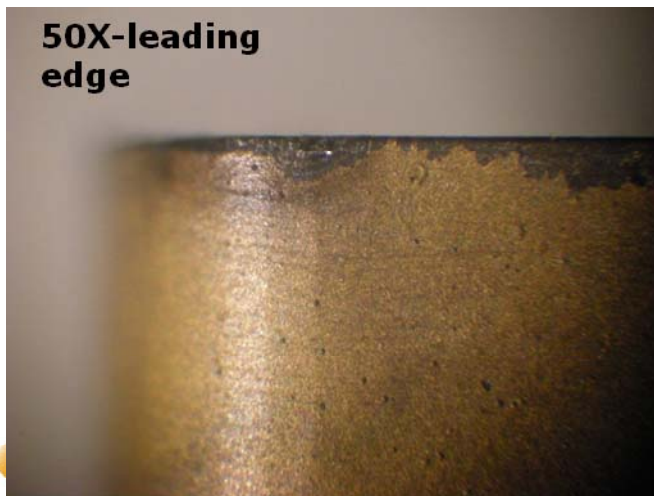
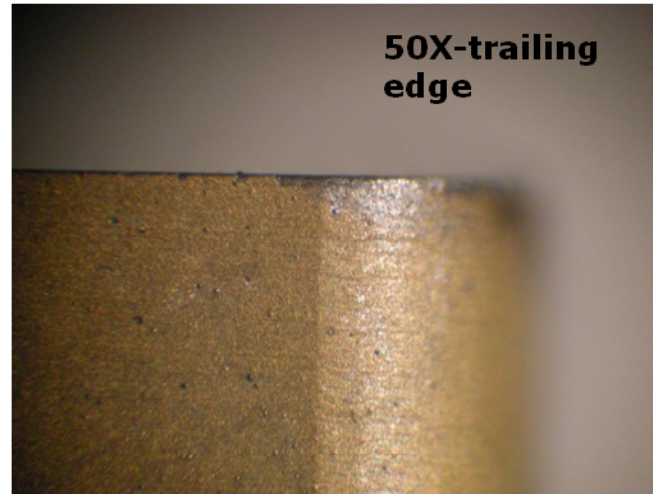
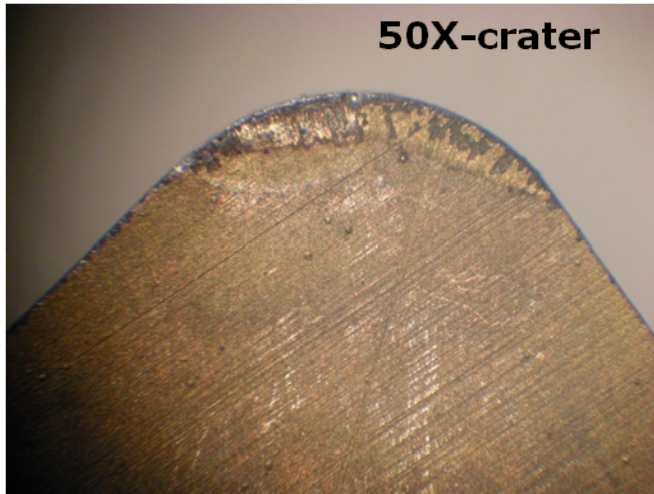


**TuffTek coated inserts outperformed benchmark inserts significantly.**



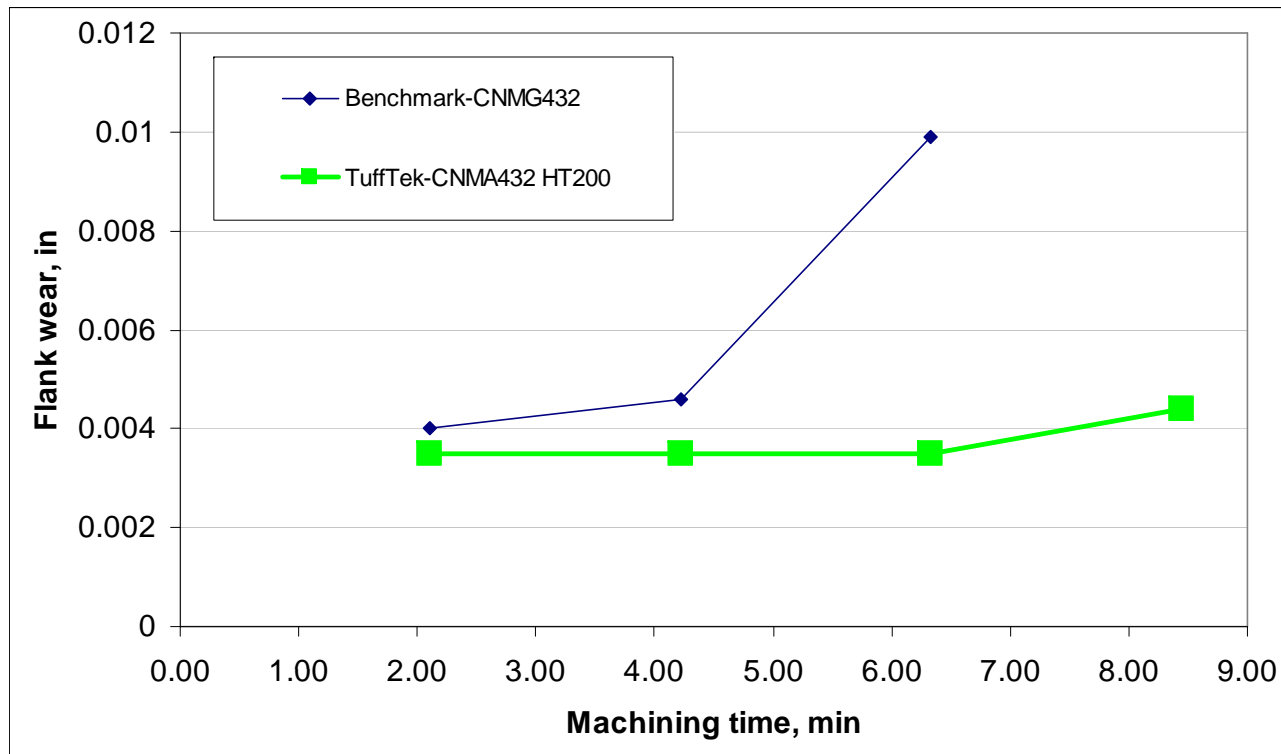
*New Development: TuffTek<sup>®</sup> Coated Inserts for Machining with Interruptions (continued)*

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**After about 20 minutes machining, cutting edges remain integral**

## *New Development: TuffTek<sup>®</sup> Coated Inserts for Machining with Interruptions (4340 with Hardness up to 54 HRC)*



**Workpiece: 4340 hardened (up to 54 HRC) steel bar with a 3/8" slot**  
**Operation: facing**  
**Surface speed: 75 m/min;**  
**Feedrate: 0.1 mm/rev;**  
**Depth of cut: 0.2 mm**  
**With cutting fluid**



**Note: Machining from 6.3 min to 8.5 min for TuffTek running dry**

