Synthesis, structure, and behaviour of a new CVD- TiB$_2$ coating with extraordinary properties for high performance applications
OUTLINE

• Introduction
• Demands
• Process
• Properties
• Performance
• Conclusion
INTRODUCTION

material properties of Ti- and Ni-Alloys

development of high performance cutting tools

carbide grade

toughness

wear resistance

heat resistance

go toing

geometry

chip forming geometry

edge reinforcement

coating
DEMANDS

hard to machine materials require specific behaviour of coating

△ highest hardness
  △ best wear resistance
  △ sufficient toughness

△ temperature barrier
  △ low heat conductivity into substrate
  △ low friction value

△ diffusion resistance
  △ significantly reduced crater wear
  △ high chemical stability

targeted coating system  ➔  CVD TiB₂

hard material matters
PROCESS

„state of the art  PVD coating process“

coating structure

uneven layer
binder-diffusion
Boron/W/Co diffusion + h-phase

uncontrolled process
PROCESS

„new developed coating process“

coating structure

even, smooth and uniform layer

perfect interface

no negative influence on substrate

controlled process
PROPERTIES

hardness [nano indentation method]

>60% higher hardness of the new CVD TiB₂ coating compared to a sputtered PVD TiB₂ coating
PROPERTIES
morphology and structure [SEM-investigation]

CVD TiB₂ coating

PVD TiB₂ coating
PERFORMANCE

machining trial at the CERATIZIT lab

milling TiAl6V4

V_c 50m/min, f_z 0.12mm, a_p 5mm, with coolant sfm=164, ipt.= .005“, d.o.c. = .197“

life time [min]

PVD-TiB2

CVD-TiB2 [CTC5240]

+ 300%
New CVD – TiB₂

• new approach for a high wear resistant coating
• efficient CVD hot wall process usable
• very smooth surface compared to conventional PVD and CVD coatings
• ultra fine grained structure (< 50 nm)
• uniform, regular morphology without textures
• good adhesion on substrate material (prooved by scratch test)

CONCLUSION

New solution for high performance applications on difficult to machine materials – CTC5240
CERATIZIT TiB$_2$ coating and high performance machining of Titanium alloys

High performance machining of Ti-alloys
XDKT 11T3… long edge profile cutter
MaxiMill C245.43.R.03, dia.=1.7” , 3 flutes

Tool life:
354.3“ way= 112min.

Result: a drop of cycle time of 30min./ pce.
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Insert: XDKT 11T308ER-F40
XDKT 11T332ER-F40

Tool: C245.40.R.03-11-32-47

Material: TiAl6V4

Cutting data:

120 sfm.
.005 ipt
d.o.c. = 1.4”
w.o.c. = \( \frac{2}{3} ” - 1 \frac{1}{2} ” \)

Tool life: 630” = 140min. & 2 components
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XDKT11T308ER- F40 CTC5240 & wear

wear patterns after
70min. = 1 component

wear patterns after
140min. = 2 components
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Machine: Starrag Heckert STC 1000
Taper: SK50

Cutting data: English & metric

247.7 sfm
.006“ ipt.
9.4“ ipm.
4.134“ d.o.c.
.866“ w.o.c.
49.8 ci/min. MRR!!!
30 min. Tool life!!!

Vc= 75.5m/min.
fz= .16mm
Vf= 240mm/min.
ae= 22mm
ap= 105mm
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**recommended cutting data (for TiAl6V4):**

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Insert: XOLX 120410ER-F40 CTC5240

Tool: AHFC.52.R.05-12/ High Feed Tool

Material: TiAl6V4

Cutting data:
150 sfm.
.35 ipt.
d.o.c. = .03"
w.o.c. = 100%

Perfect tool to plunge in Titanium!
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recommended cutting data (TiAl6V4):
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Thanks!