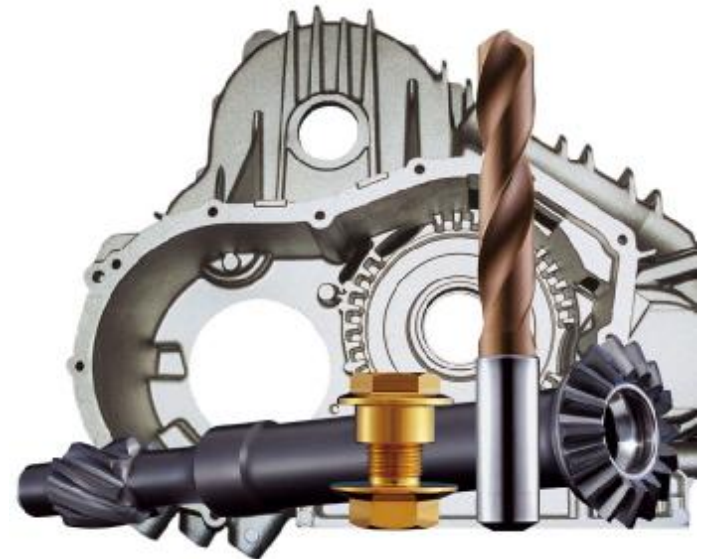


G6—your best choose of cutting tools

第六代涂层一切削刀具的最佳选择

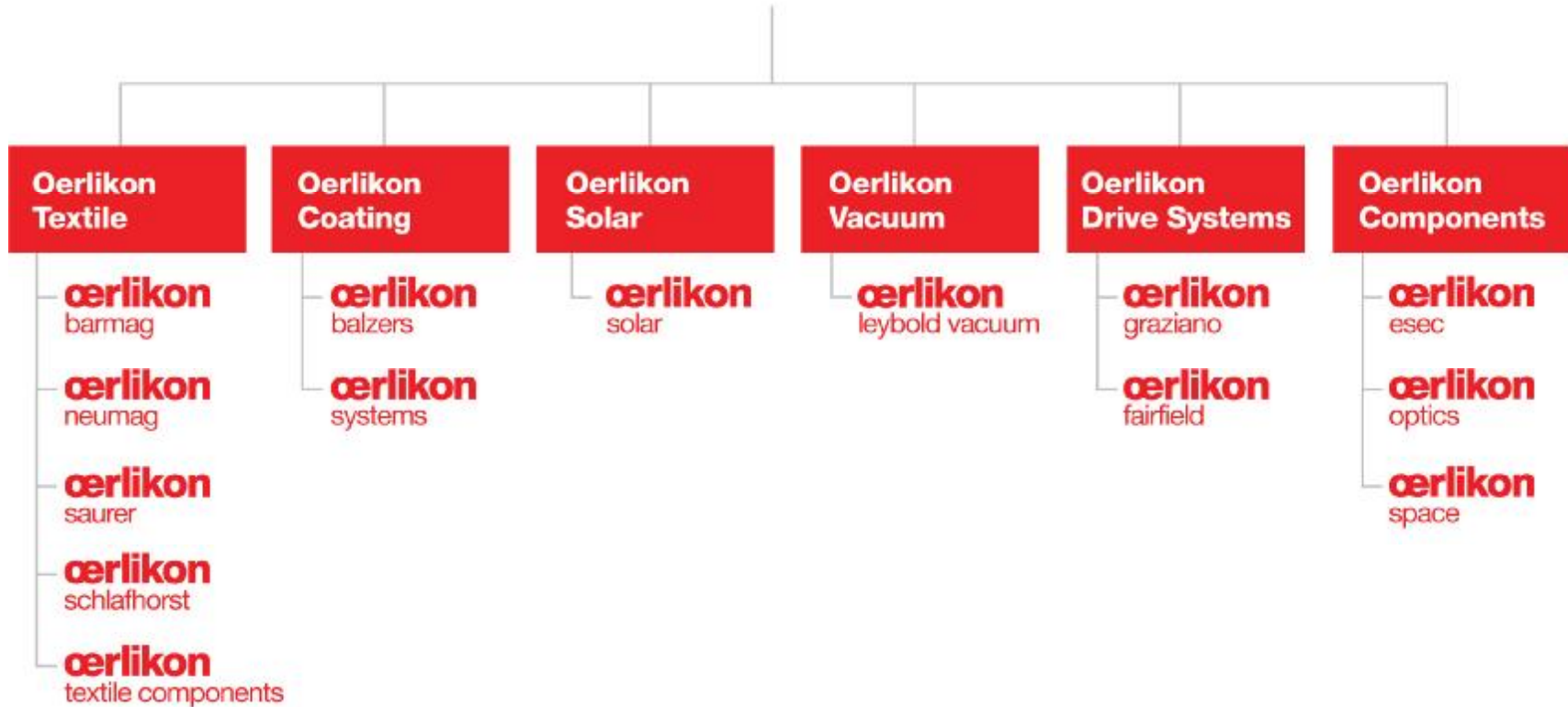
Ray Jin
金敏

7th Nov 2008



Company Overview 公司概况

oerlikon



Key data for Business Unit Coating Services

涂层服务事业部的重要数据

- § Unique company with global network for coating service
- § 唯一拥有全球涂层服务网络的公司
- § More than 80 coating centres in 28 countries
- § 在28个国家有80多个涂层中心
- § 30% global market share (job coating)
- § 占全球市场份额的30%（涂层服务）
- § About 500 coating systems in operation
- § 大约有500个涂层系统在运行中



Close to you – anywhere in the world
在您身边---我们无处不在



As of June 2007
至2007年6月

locations and market regions in China
在中国的地址和市场区域



- 1 Oerlikon Balzers Coating (Suzhou) Co, Ltd
Head office 苏州总部
SOP April 2004
2004年4月开始生产
- 2 Oerlikon Balzers Coating (Hangzhong) Co, Ltd
In-house center 汉中现场涂层中心
SOP December 2005
2005年11月开始生产
- 3 Oerlikon Balzers Coating (Tianjin) Co, Ltd
天津涂层中心
SOP Nov.2006
2006年11月开始生产
- 4 Oerlikon Balzers Coating (Chengdu) Co.,Ltd
成都涂层中心
SOP Dec.2007
2007年12月开始生产
- 5 6 Opening soon 筹办中
Sales office 销售办公室
- 7

Tailor-made solutions for all requirements 多元化的解决方案满足您的各种需要

Coating service 涂层服务



- Pick-up service 取货服务
- Short and dedicated delivery times 交货期短
- Centres in 26 countries 在26个国家都有涂层中心

Shop-in-Shop centres 现场涂层中心 Coating systems 涂层设备



- Customised coating lines
- 客制化的涂层线
- integrated into the customers facilities; run by us
- 我们在客户的现场提供涂层服务
- 10 centres in operation; 已经有10个现场涂层中心



- Highly productive and reliable equipment 提高生产效率，设备可靠度。
- About 500 coating systems in operation world-wide 在全球有500多个涂层系统。

Leading companies rely on us 信赖我们的领先公司

- Tool manufacturers 工具制造
- Automotive industry 汽车工业
- Aircraft industry 航空航天业
- Metalworking industry 金属加工业
- Plastics processing industry 塑料加工业
- Mechanical engineering and plant construction 机械加工



BOSCH



BRAUN

SIEMENS



ABB



SANDVIK



SKF

BALINIT®
X.TREME



1996/97

BALINIT®
DIAMOND



1998

BALINIT®
HARDLUBE



1998

BALINIT®
FUTURA TOP



2000

BALINIT® DLC



2001

BALINIT®
FUTURA



1996

**With innovations from Balzers
always one step ahead!**

BALINIT® C



1995

BALINIT® HELICA



2005

BALINIT® ALCRONA



2003

BALINIT® X.CEED



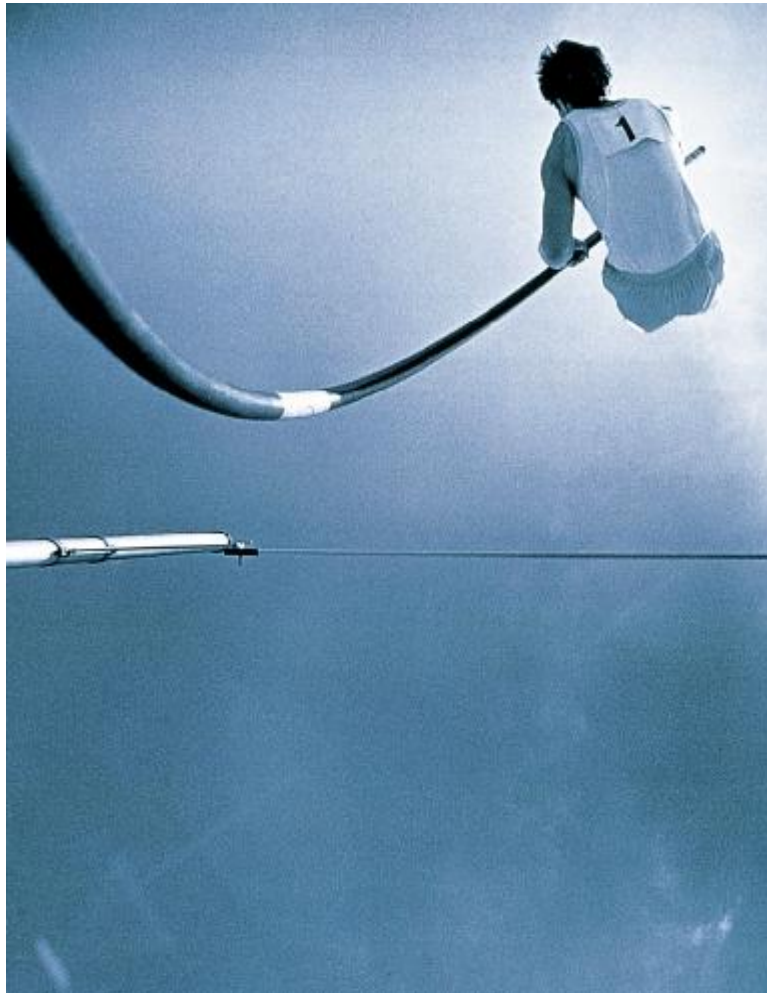
2002

BALINIT®
FUTURA
NANO



2001

G6 - superior properties



Improved wear resistance

改善抗磨损性

Improved hot hardness

改善红硬性

Improved oxidation resistance

改善抗氧化性



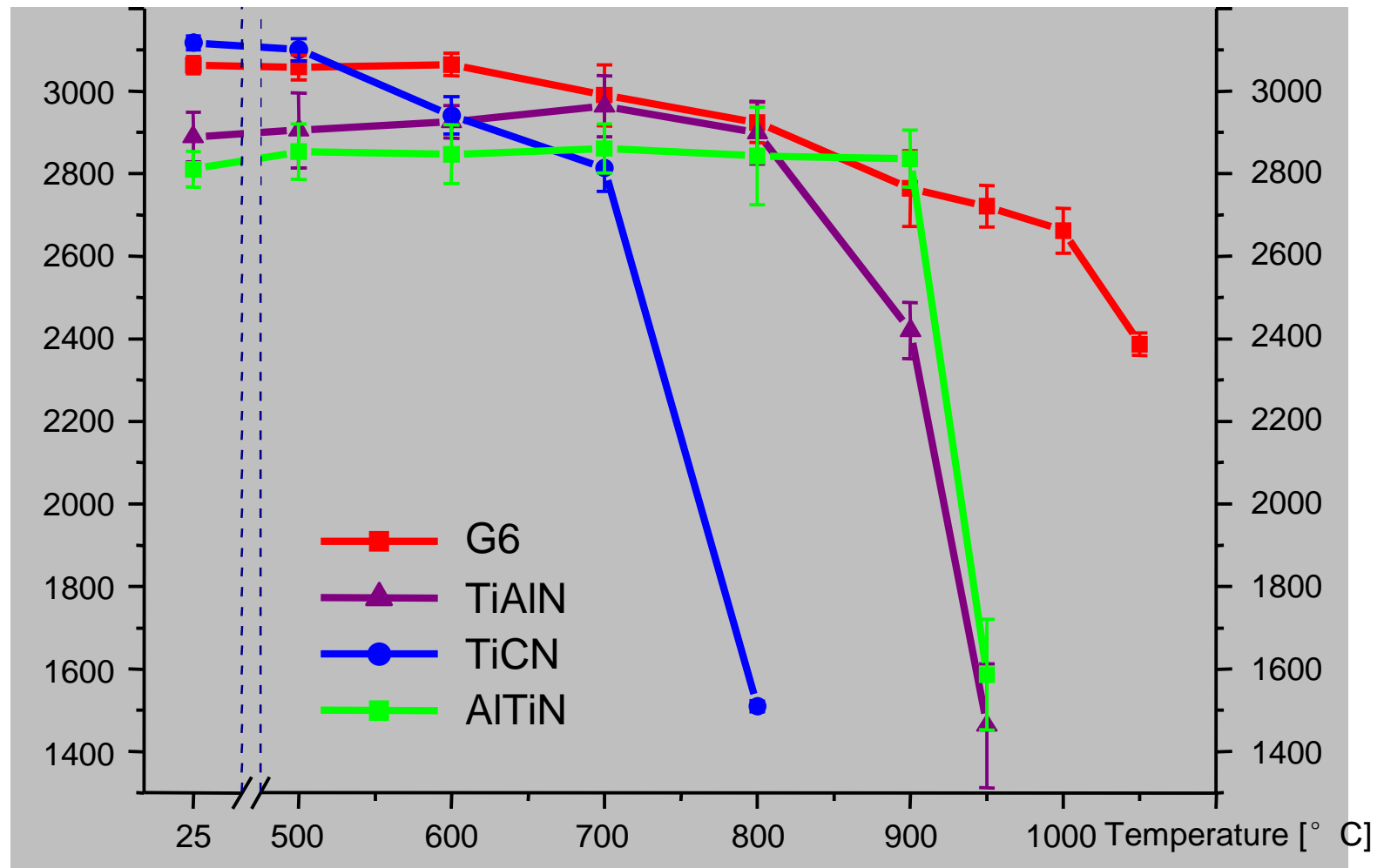
G6 = Al-Cr-N

Ti-free coating

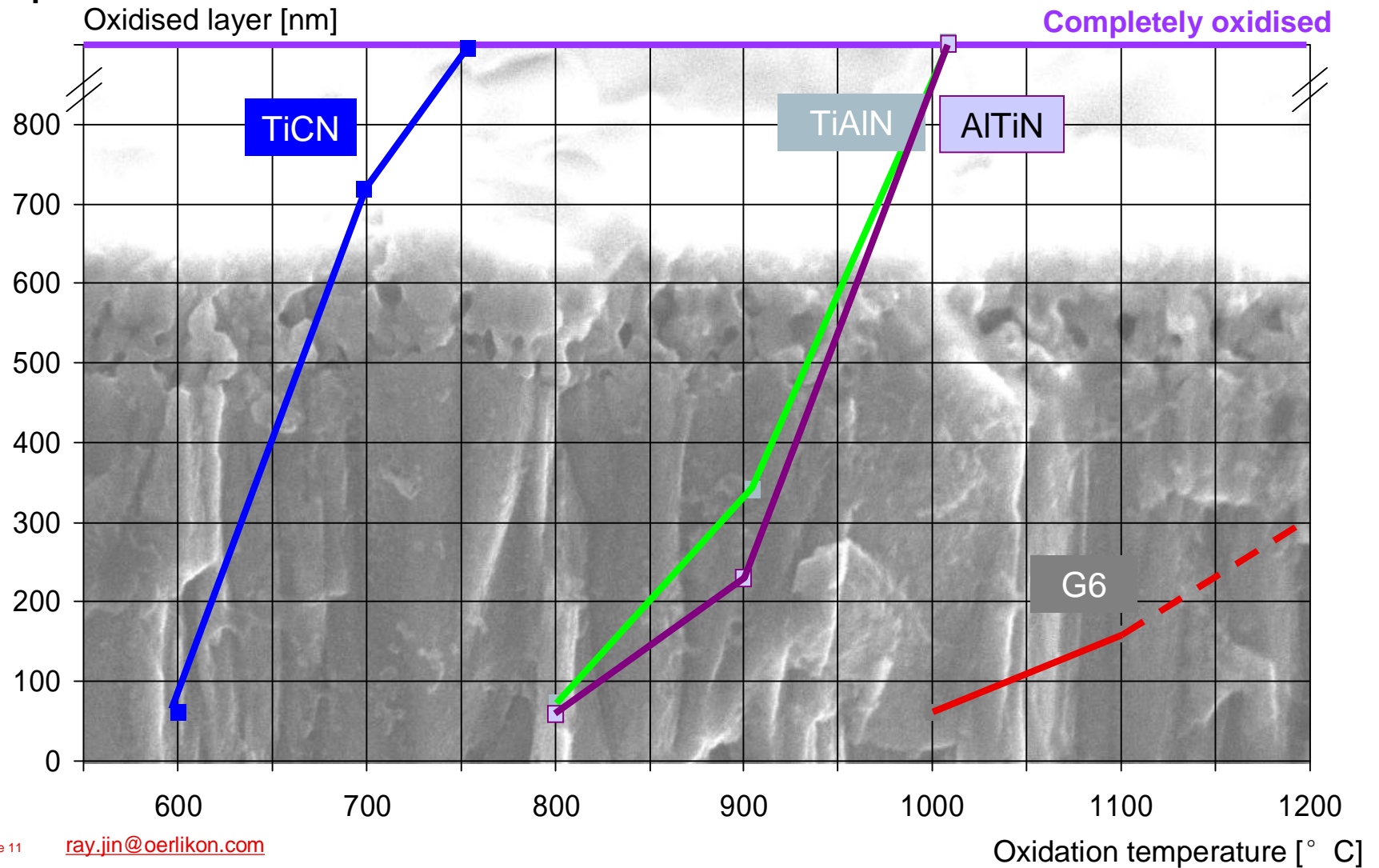
不含钛的涂层

Improved hot hardness

Hardness HV (0.05)

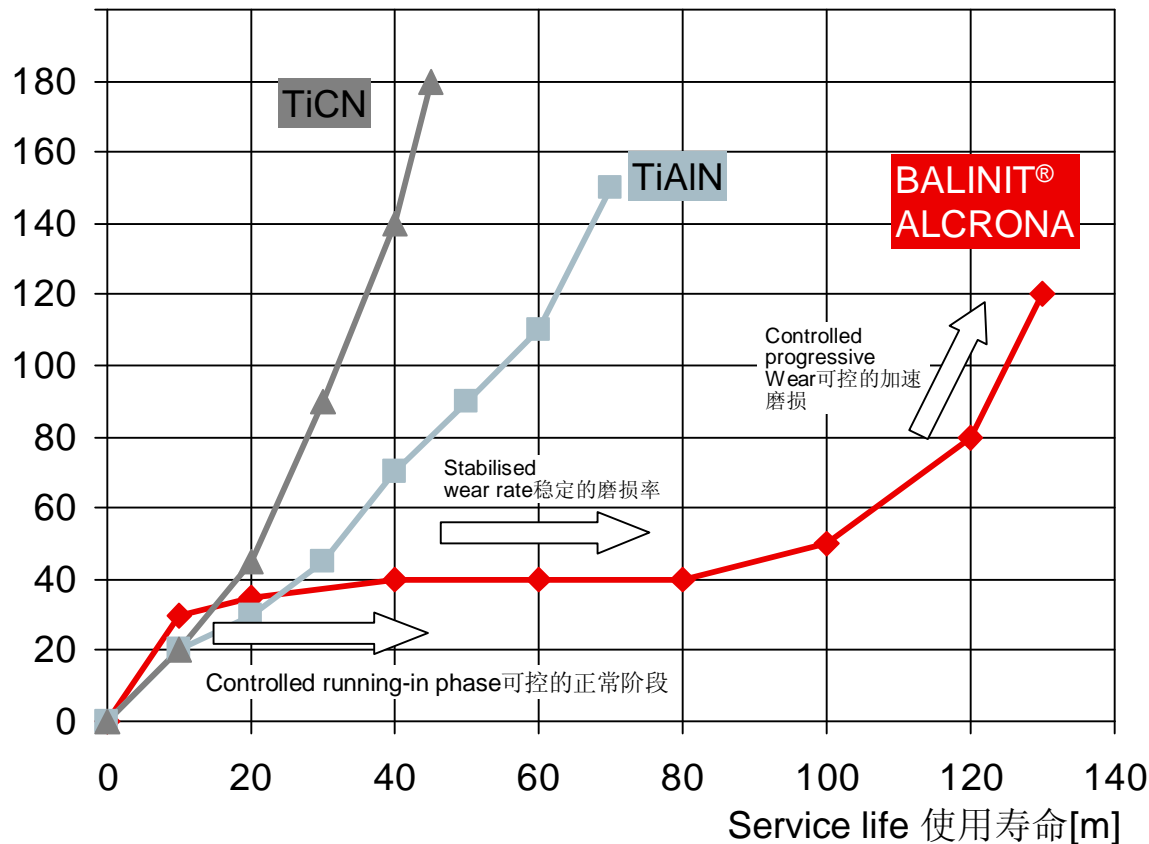


Improved oxidation behaviour



Carbide finishing 硬质合金精加工

Width of flank wear land 后刀面磨损宽度VB [μm]



Tool 工具
Carbide end mill
硬质合金立铣刀
D = 8 mm

Workpiece 工件
Steel 钢
DIN 1.1191 (~AISI 1045)

Cutting parameters 切削参数
 $v_c = 400 \text{ m/min}$
 $f_t = 0.1 \text{ mm}$
 $a_e = 0.5 \text{ mm}$
 $a_p = 10 \text{ mm}$
Down-cut milling
Emulsion 5%
润滑 5%

Source 资料来源
Oerlikon Balzers Coating
cutting laboratory
欧瑞康巴尔查斯切削实验室

BALINIT® HELICA

Gives your drills that extra twist 使您的钻头表现卓越



BALINIT® HELICA

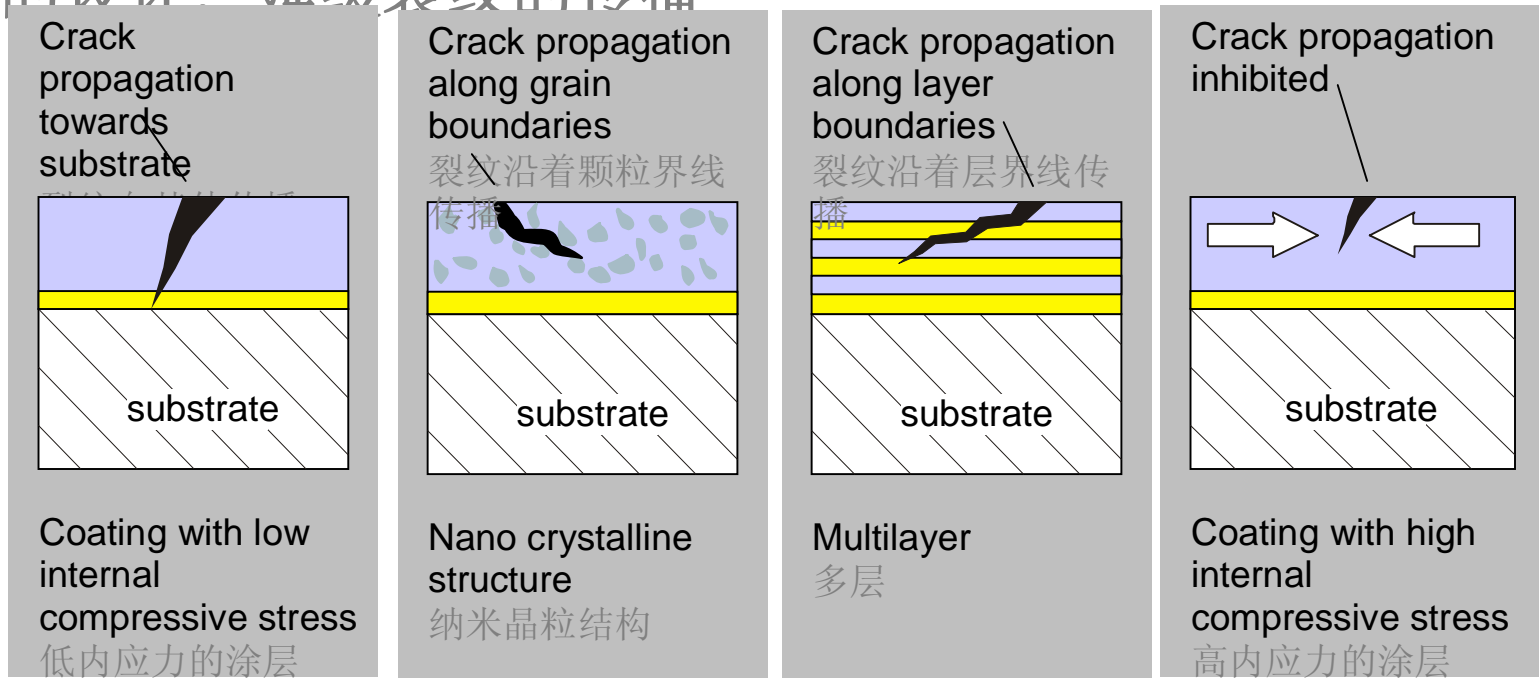
New coating for drills 适用于钻头的新涂层



- Second G6 generation coating
- G6代的第二款涂层
- Multilayer 多层结构
- AlCr-based 铬铝基涂层
- For all conventional steel and cast iron grades 适用于各类钢材和铸铁
- With internal and external cooling as well as for dry machining or with minimum quantity lubrication (MQL)
- 对外冷和内冷钻都适用，甚至是干式加工或最小量润滑的加工
- Extremely smooth surface 超光滑的表面
- Colour: copper 颜色：铜色

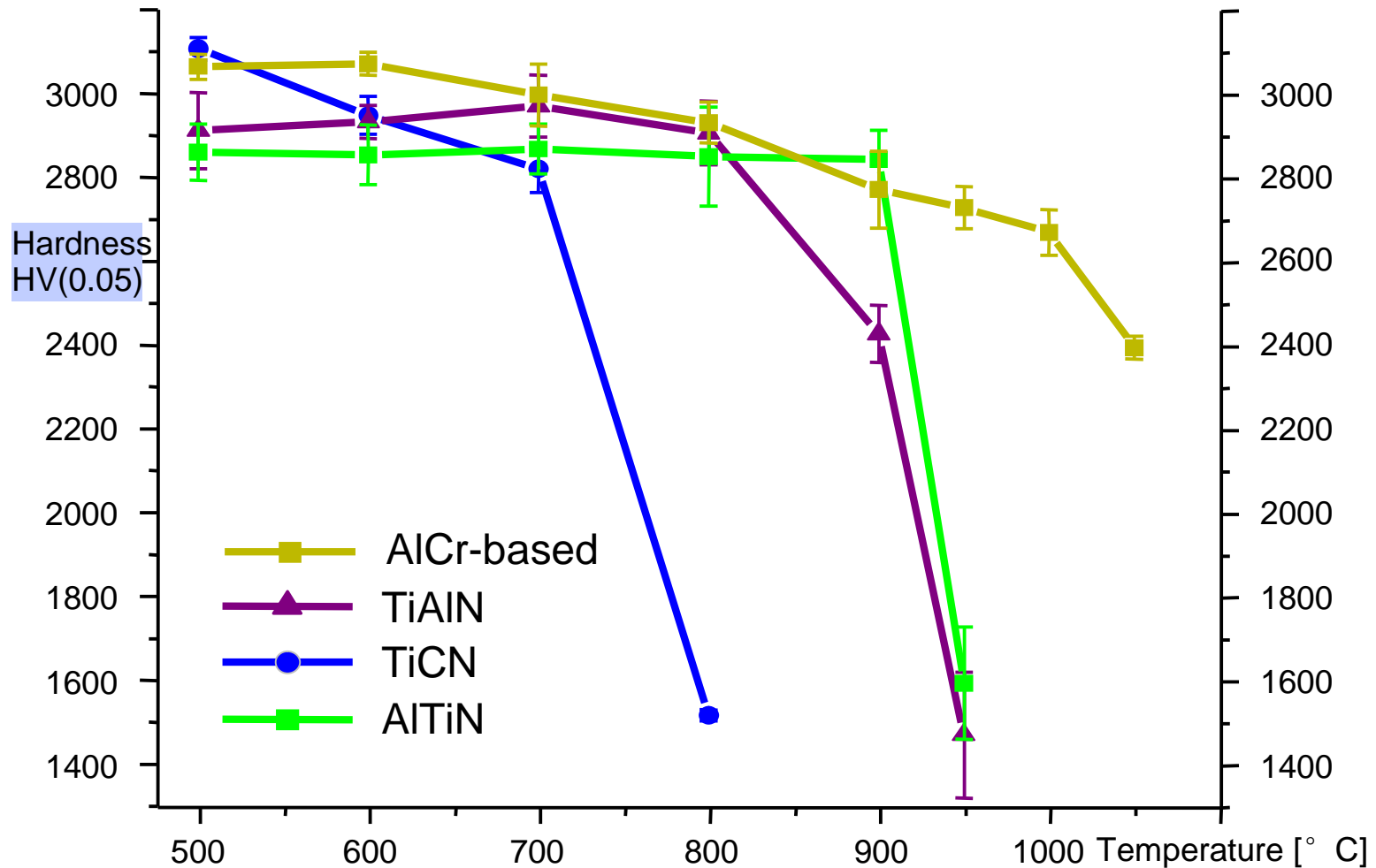
Design of coatings: crack retardation

涂层的设计. 延缓裂纹的传播

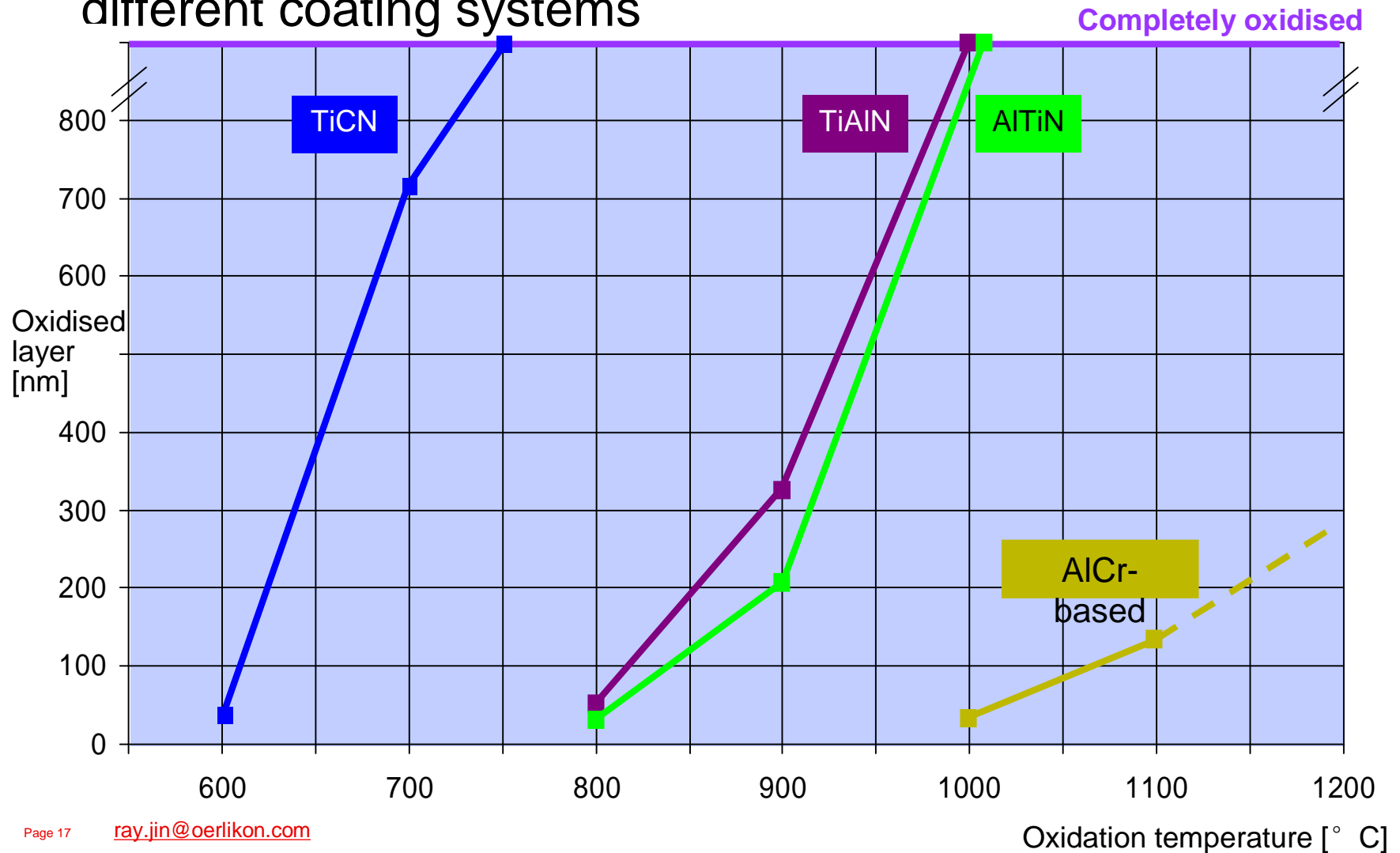


- Coating fracture toughness is as important as its hardness
- 涂层的韧性与涂层的硬度一样重要
- Balance between too high compressive stress (poor adhesion) and low residual stress (no crack retardation)
- 平衡高压力（差的附着性）和低的残余应力（不延缓裂纹传播）

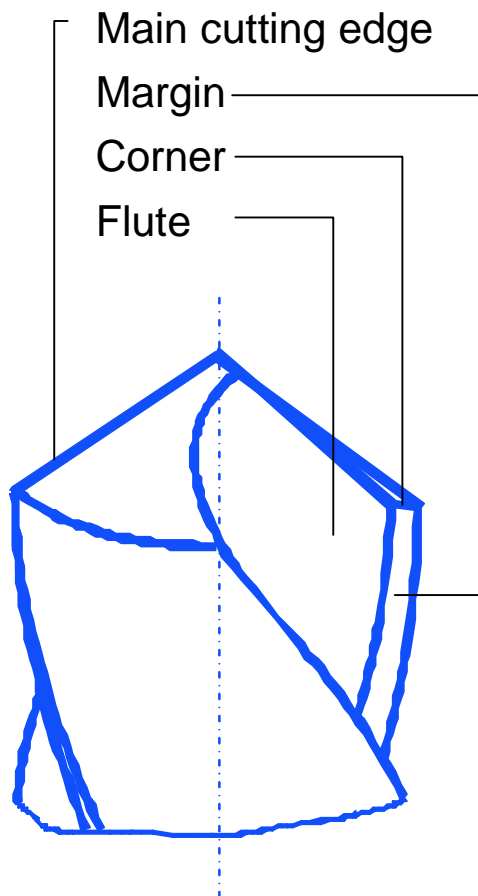
Comparison of hot hardness for different coating systems



Comparison of oxidation resistance for different coating systems



Characteristics of BALINIT® HELICA BALINIT® HELICA 的性质



Main cutting edge主切削刃

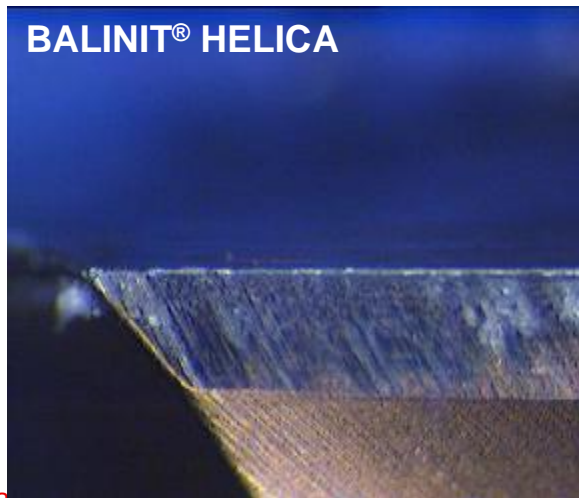
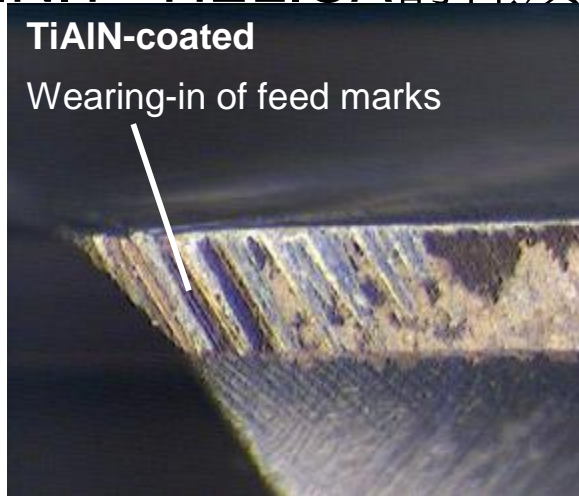
- Very little wear due to high abrasion resistance of AlCr-base 由于铬铝基涂层的高抗磨损性能带来最少量的磨损
- Low tendency towards cratering on the main cutting edge主切削刃的低磨损趋势
- Very little chisel-edge wear 最少量的刃口磨损

Flute排屑槽

- Very low tendency towards adhesion due to AlCr-base 铬铝基的涂层能降低粘连趋势
- Excellent chip evacuation due to very smooth surface超光滑的表面能使排屑顺畅

Characteristics of BALINIT® HELICA

BALINIT® HELICA的性质



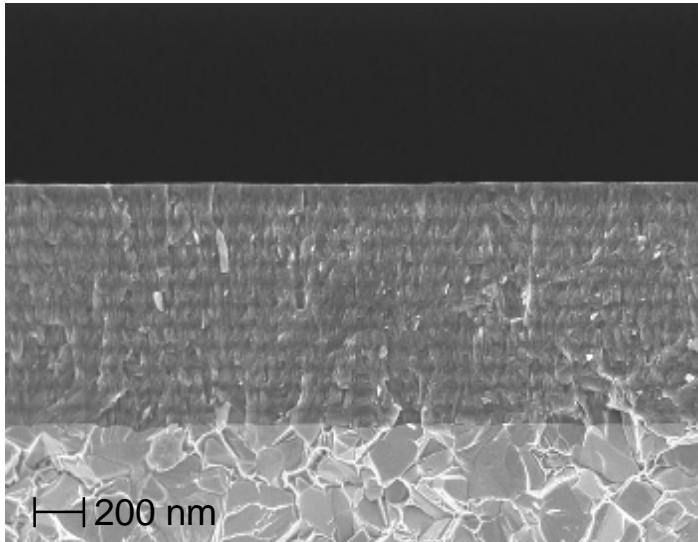
Margin刃带

- Highly homogeneous wear due to high shear strength of AlCr-base and because of multilayer structure 由于铬铝基涂层的高剪切强度和多层结构能带来高度统一的磨损状态
- No wearing-in of feed marks due to high abrasion resistance 高抗磨损性能降低刃带的磨损
- Excellent prerequisites for regrinding and recoating 可以增加重磨次数和重涂

Cutting edge corner后角

- High corner edge stability due to excellent oxidation resistance and hot hardness 由于涂层的抗氧化性和红硬性能带来高度的后角稳定性
- Less tendency towards cracking and improved toughness due to multilayer structure 多层结构能降低裂缝产生的趋势并能提升韧性

BALINIT® HELICA – Facts and figures 事实和数据



Structure结构	AlCr-based铬铝基 Multilayer多层
Hardness硬度 HV 0.05	3,000
Residual stress 残余应力 [GPa]	- 3.0
Max. service temperature 最高适用温度[° C]	1,100
Coefficient of friction 摩擦系数	0.25

- Very low wear due to high abrasion resistance高抗磨损性能带来低磨损
- Very low tendency towards adhesion due to AlCr-base 铬铝基的涂层能带来超低的粘连趋势
- Excellent chip evacuation due to very smooth surface超光滑的表面能使得排屑顺畅
- Highly homogeneous wear due to high shear strength of multilayer structure由于铬铝基涂层的高剪切强度和多层结构能带来高度统一的磨损状态
- Less tendency towards cracking and improved toughness due to multilayer structure多层结构能降低裂缝产生的趋势并能提升韧性

Where BALINIT® HELICA is successfully used for drilling
BALINIT® HELICA 在这里被成功应用于钻削

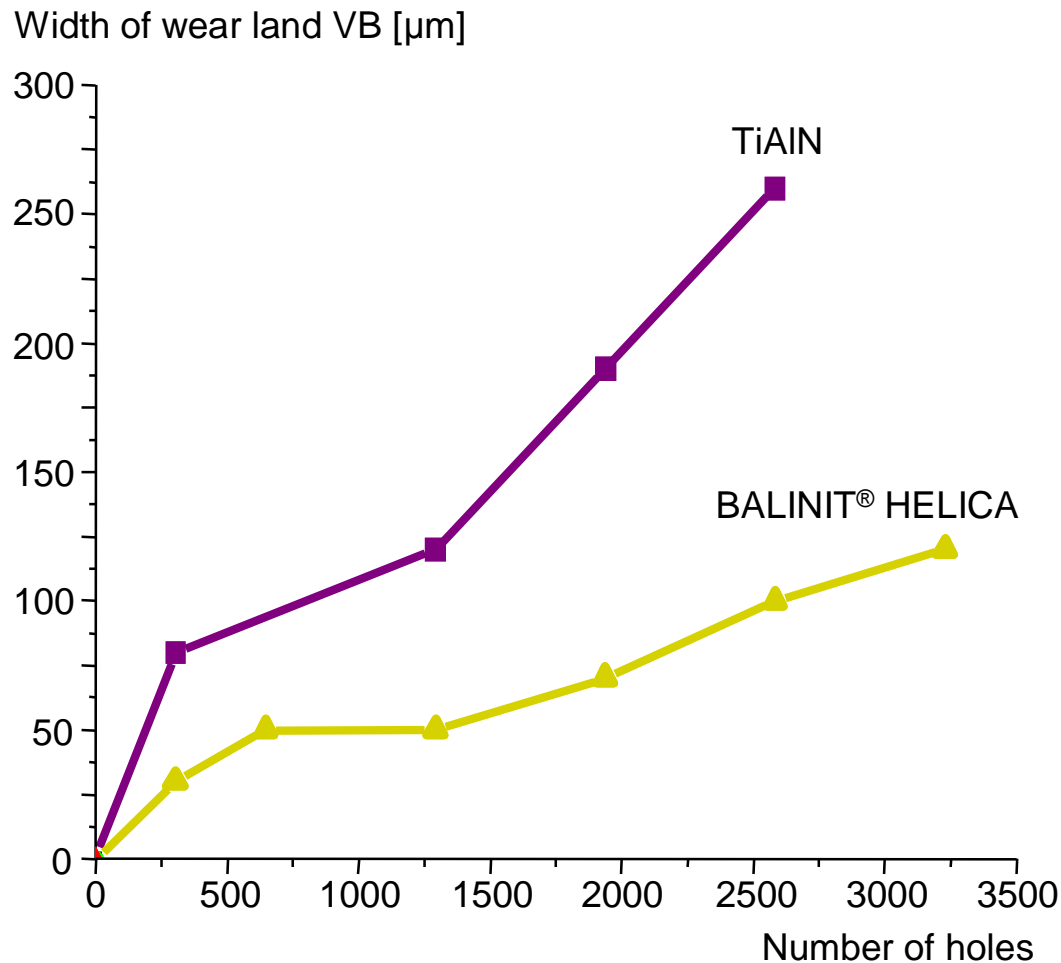
Material	High speed steel HSS		Cemented carbide	
	Dry Mist lubrication	Wet	Dry Mist lubrication	Wet
Unalloyed steel	+	++	++	++
Steel < 1000 N/mm ²	+	++	++	++
Steel > 1000 N/mm ²	+	++	++	++
Steel 45 - 52 HRC	0	0	++	++
Stainless steel	0	++	++	++
Cast iron (GJL, GJS)	+	++	++	++

++ very good + good 0 not yet tested

BALINIT® HELICA application results



Improved stability of the cutting edge corner



Tool

Solid carbide drill
 \varnothing 6.8 mm

Workpiece

Steel AISI 1045
(DIN 1.1191 / Ck45)

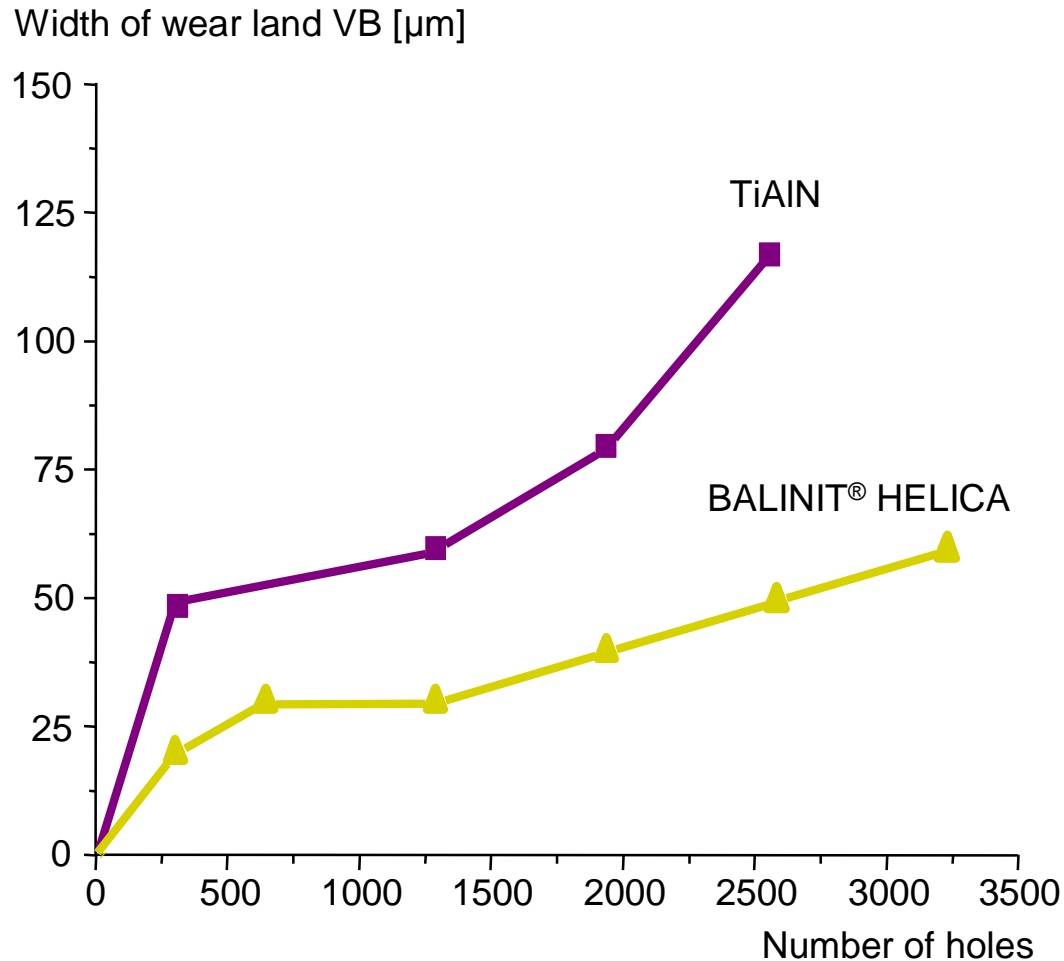
Cutting data

$v_c = 120$ m/min
 $f = 0.2$ mm/rev
Hole depth 5xD
External cooling

Source

Balzers cutting
laboratory

Reduced wear of the main cutting edge



Tool

Solid carbide drill
 \varnothing 6.8 mm

Workpiece

Steel AISI 1045
(DIN 1.1191 / Ck45)

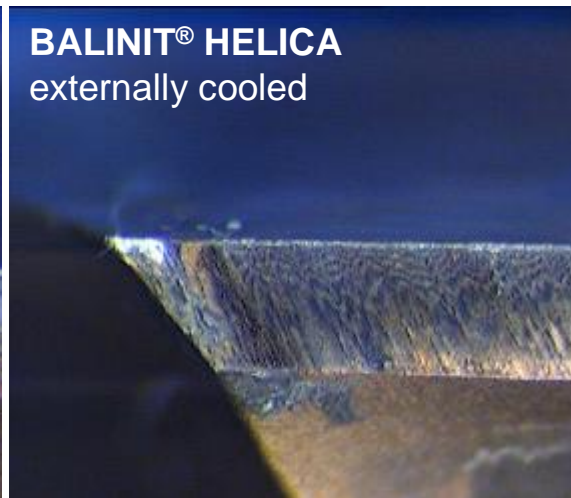
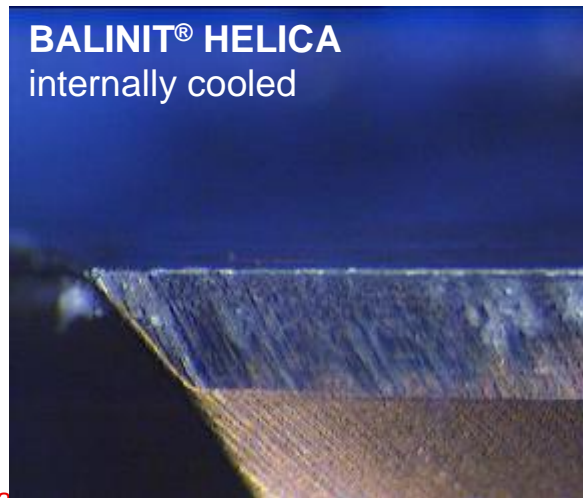
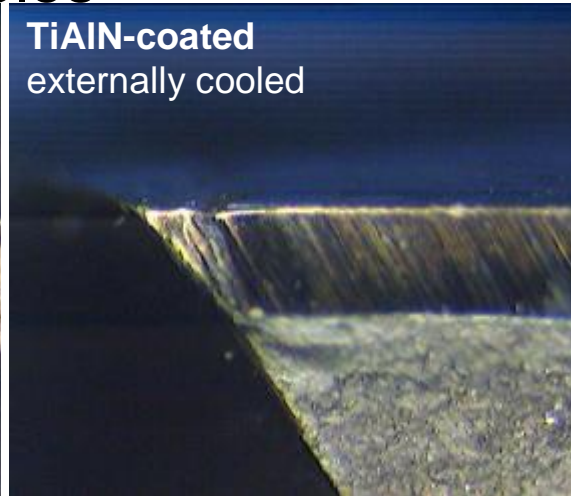
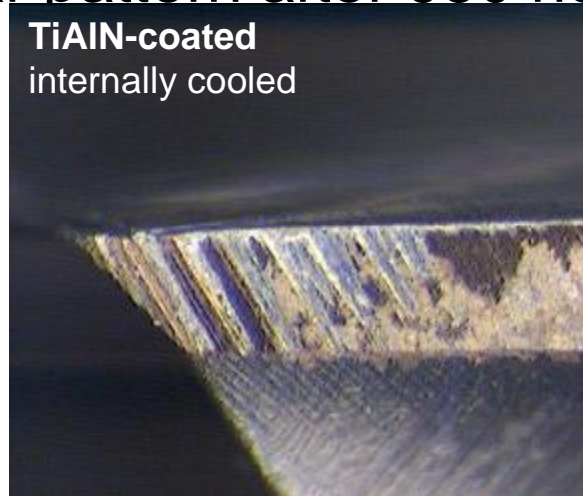
Cutting data

$v_c = 120$ m/min
 $f = 0.2$ mm/rev
Hole depth 5xD
External cooling

Source

Balzers cutting
laboratory

Drill margin Wear pattern after 950 holes

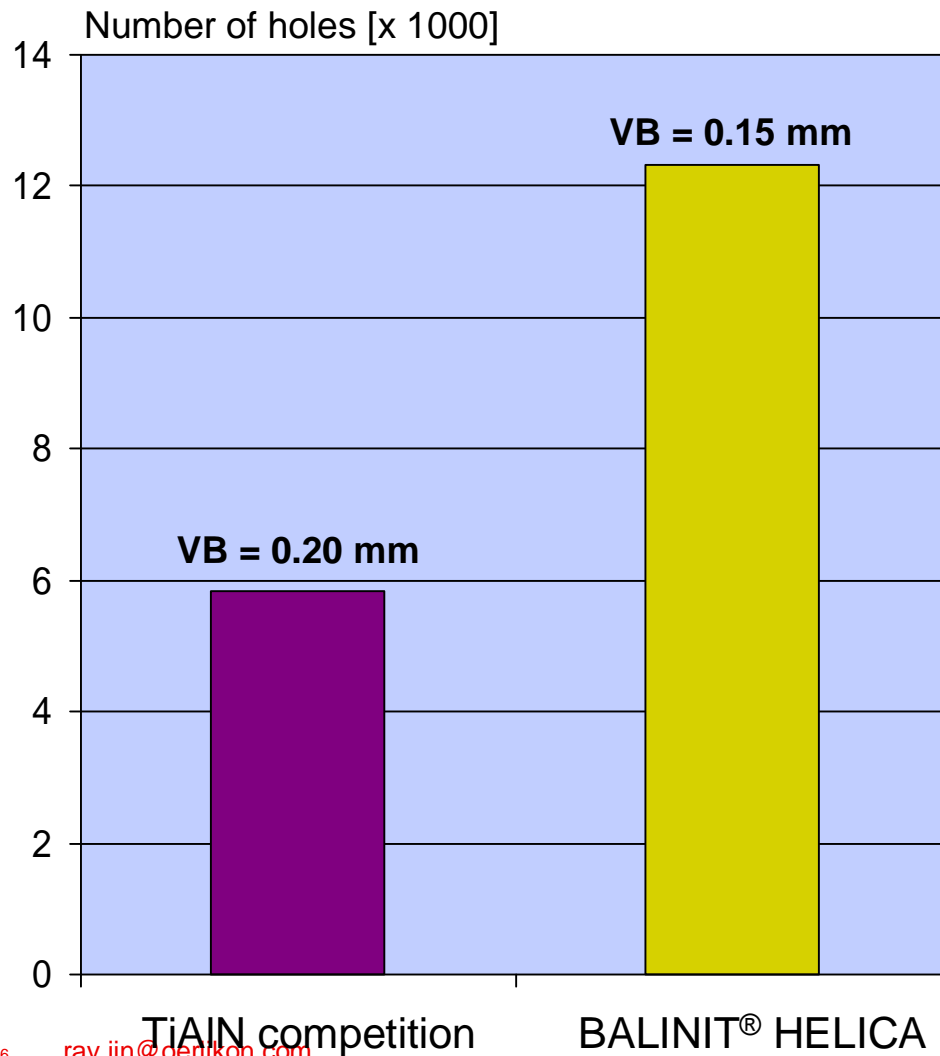


Tool
Solid carbide drill
Ø 6.8 mm

Workpiece
Steel AISI 1045
(DIN 1.1191 /
Ck45)

Cutting data
 $v_c = 120$ m/min
 $f = 0.2$ mm/rev
Hole depth 5xD

Drilling in steel



Tool

Solid carbide twist drill
Ø 6 mm

Workpiece

Steel AISI 1045 (DIN 1.1191)

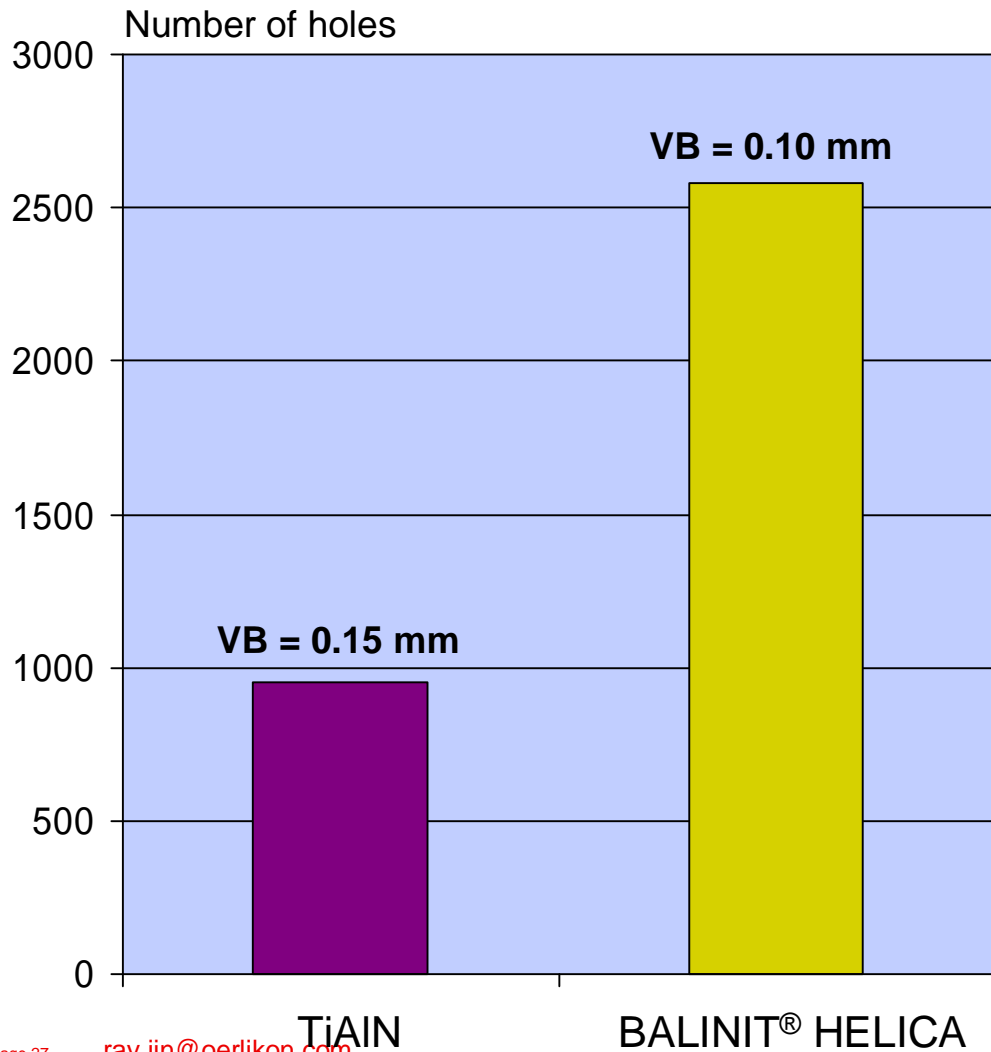
Cutting data

$v_c = 80$ m/min
 $f = 0.16$ mm/rev
Hole depth 4xD
Internal cooling with emulsion

Source

Tool manufacturer

Drilling in steel with increased cutting speed



Tool

Solid carbide twist drill
Ø 6.8 mm

Workpiece

Steel AISI 1045 (DIN 1.1191)

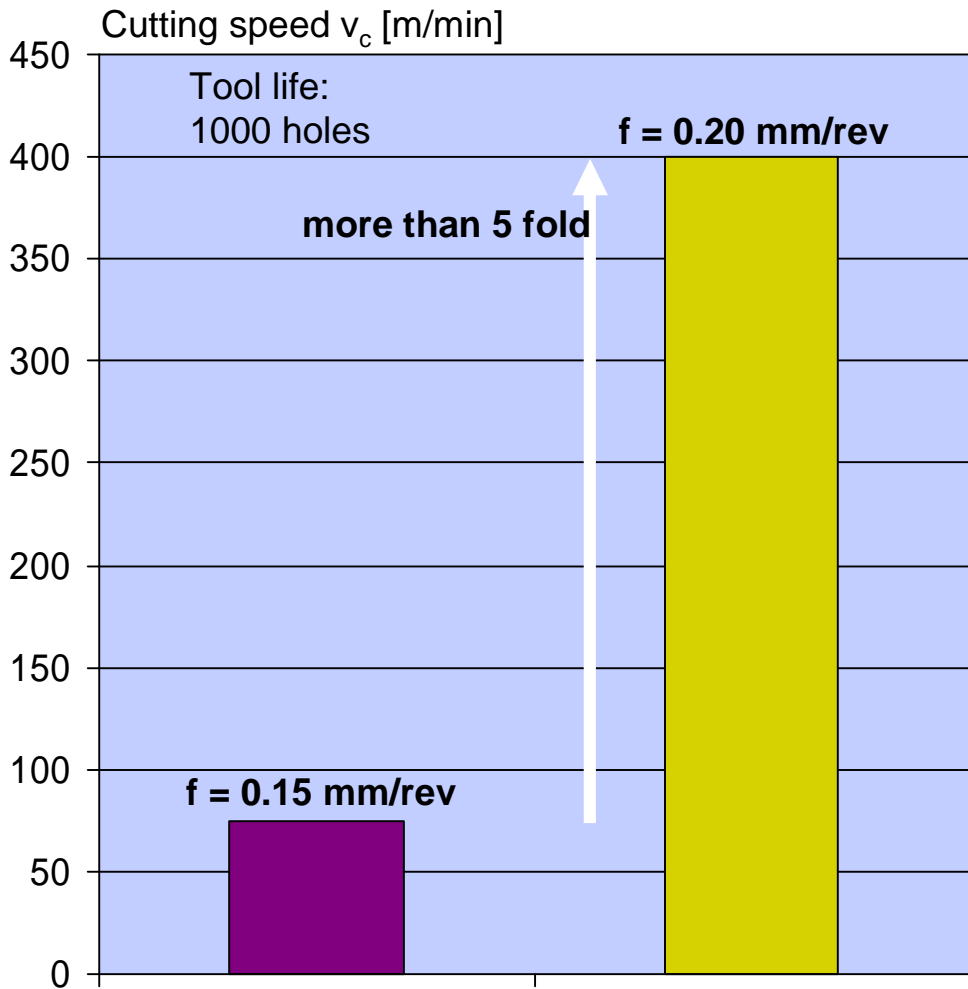
Cutting data

$v_c = 120$ m/min
 $f = 0.2$ mm/rev
Hole depth 5xD
Internal cooling with emulsion

Source

Balzers cutting laboratory

Drilling in cast iron



Tool
Solid carbide twist drill
Ø 6.8 mm

Workpiece
Cast iron DIN 0.750 (EN-GJS-500-7)

Cutting data
Hole depth 4.5xD
Internal cooling

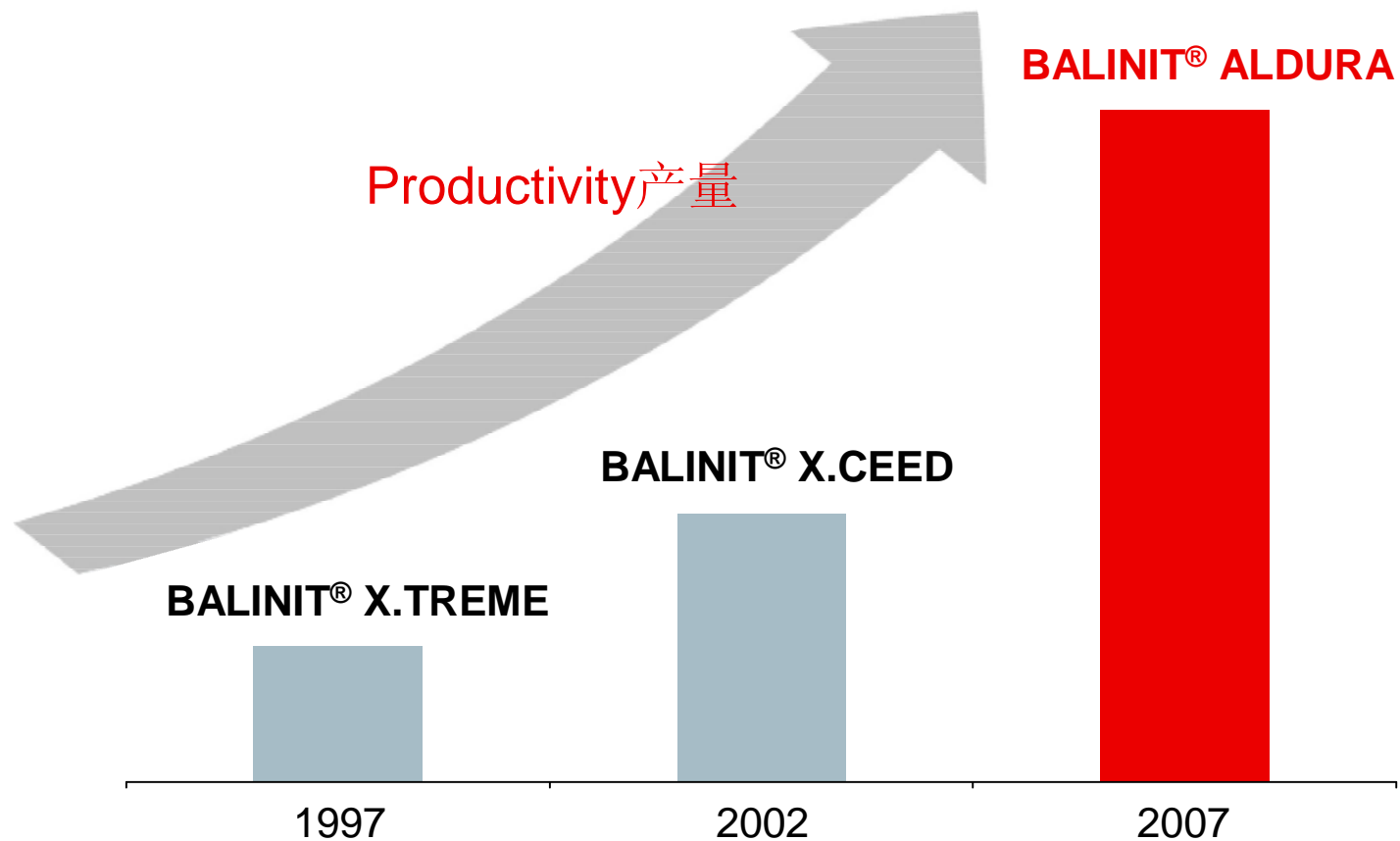
Source
Sphinx Werkzeuge AG
Switzerland

BALINIT[®] ALDURA Cut the hardest materials - rapidly and reliably

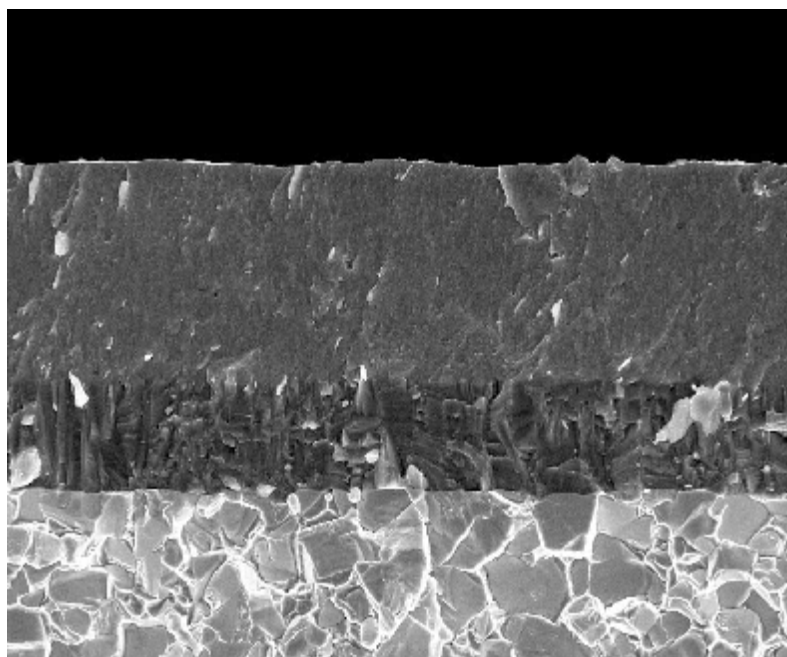
快速稳定的切削最硬的
08年9月



Increased productivity through BALINIT® ALDURA 通过BALINIT® ALDURA提升产量



The novel dual structure of BALINIT® ALDURA BALINIT® ALDURA独特的双层结构



Functional layer 功能层

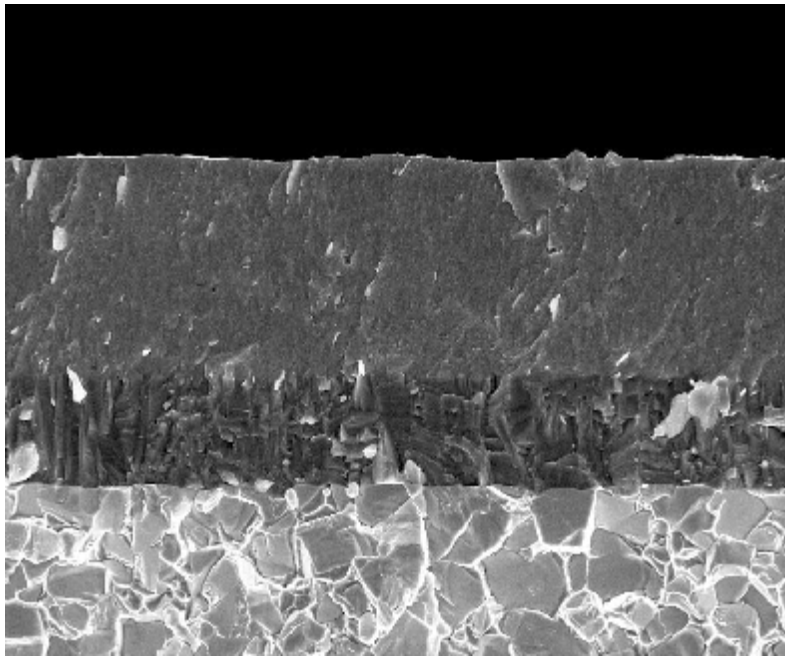
advanced AlCrN-based high performance coating
卓越的氮铬化铝基高效涂层

Support layer 支持层

perfectly adapted TiAlN coating
完美配比的氮铝化钛涂层

Cemented carbide substrate
硬质合金基体

Properties of BALINIT® ALDURA BALINIT® ALDURA性质

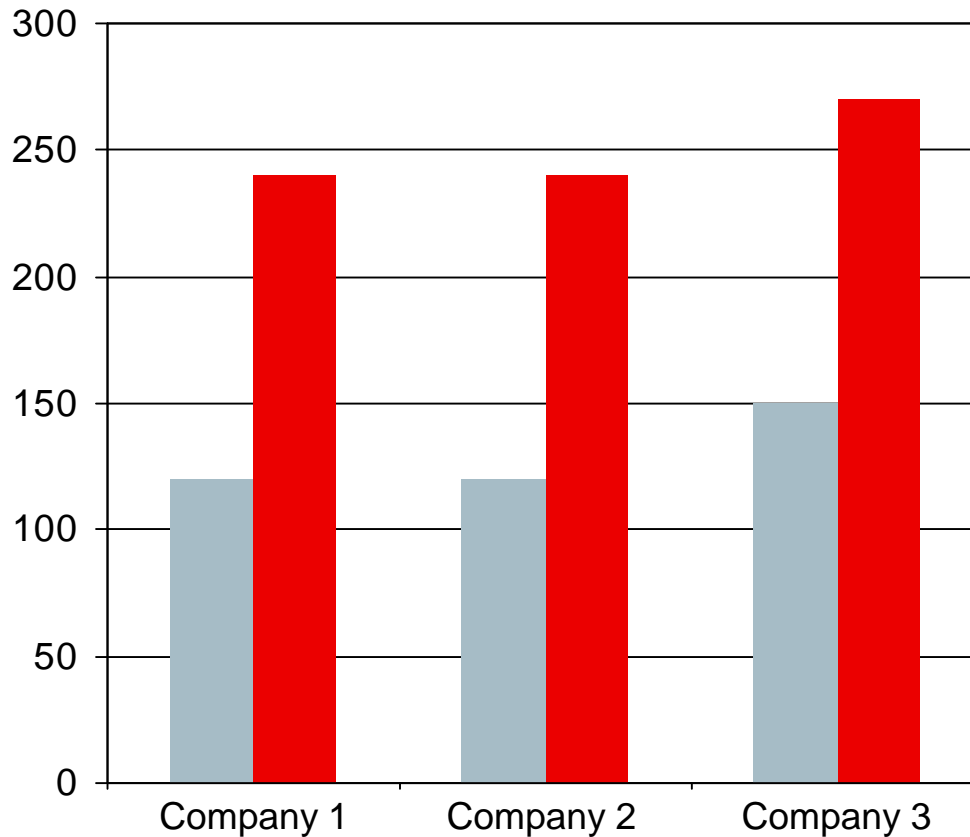


Coating properties涂层性质

- § Nanocrystalline structure 纳米晶体结构
- § High micro hardness
高维氏硬度(3300 HV_{0.05})
- § High hot hardness 高红硬性
- § High oxidation resistance
高抗氧化性(> 1100 °C)
- § High compressive residual stress
高压应力(-3 GPa)

Comparison of standard products for milling 60 HRC steel 铣削60HRC钢材的比较

Cutting length 切削长度 [m]



Tool 工具

Ball nose end mill 球头铣刀, D = 10 mm

Workpiece 工件

Steel 钢 DIN 1.2379 (~AISI D2 / SKD 11)

Cutting data 切削参数



$v_c = 200$ m/min

$f_t = 0.15$ mm

$a_e = 0.5$ mm / $a_p = 0.3$ mm

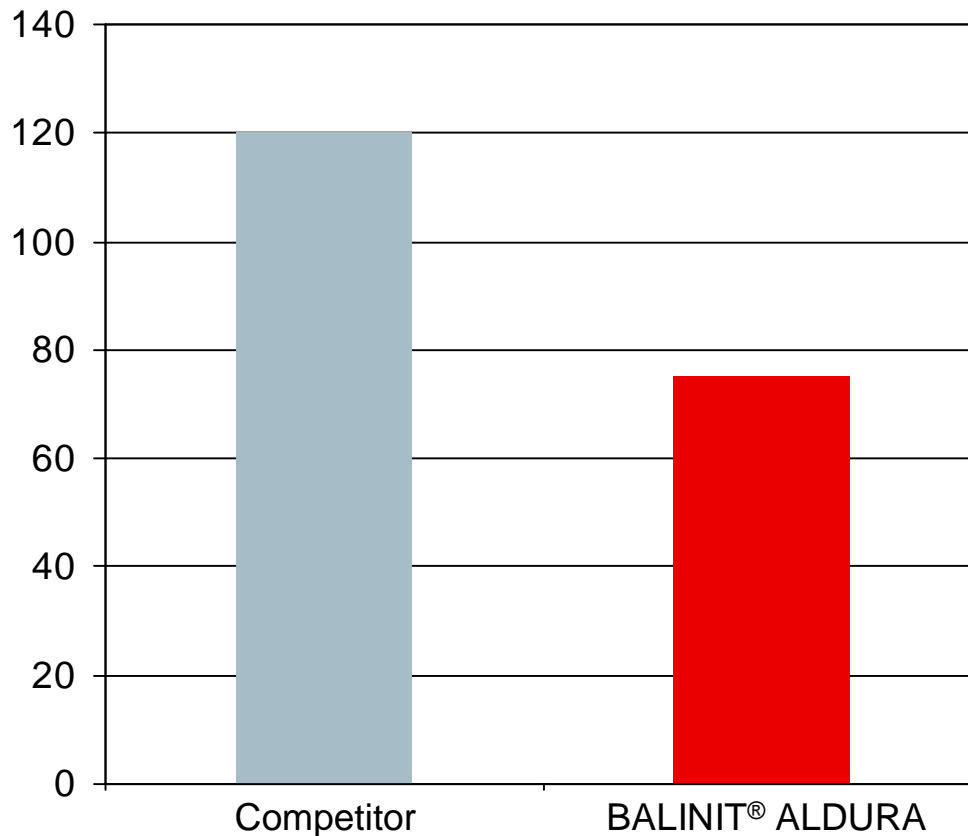
VB = 0.1 mm

Dry 干

-  Tool of each company
各个公司的工具 + their coating 各自的涂层
-  Tool of each company
各个公司的工具 + BALINIT®
ALDURA

Finishing of HRC 62 steel 精加工HRC62

Width of wear mark 磨损宽度 [μm] after 66 min 66分钟以后



Tool工具

Ball nose end mill 球头铣刀R3 / Z2

Workpiece工件

Steel钢 DIN 1.3352 (ASP 2053)

Cutting data切削参数

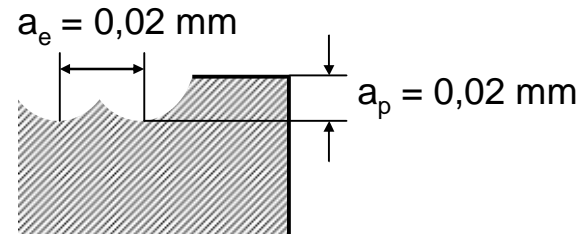
$n = 10,000$ rpm

$v_f = 2,600$ mm/min

Cooling 冷却MQL

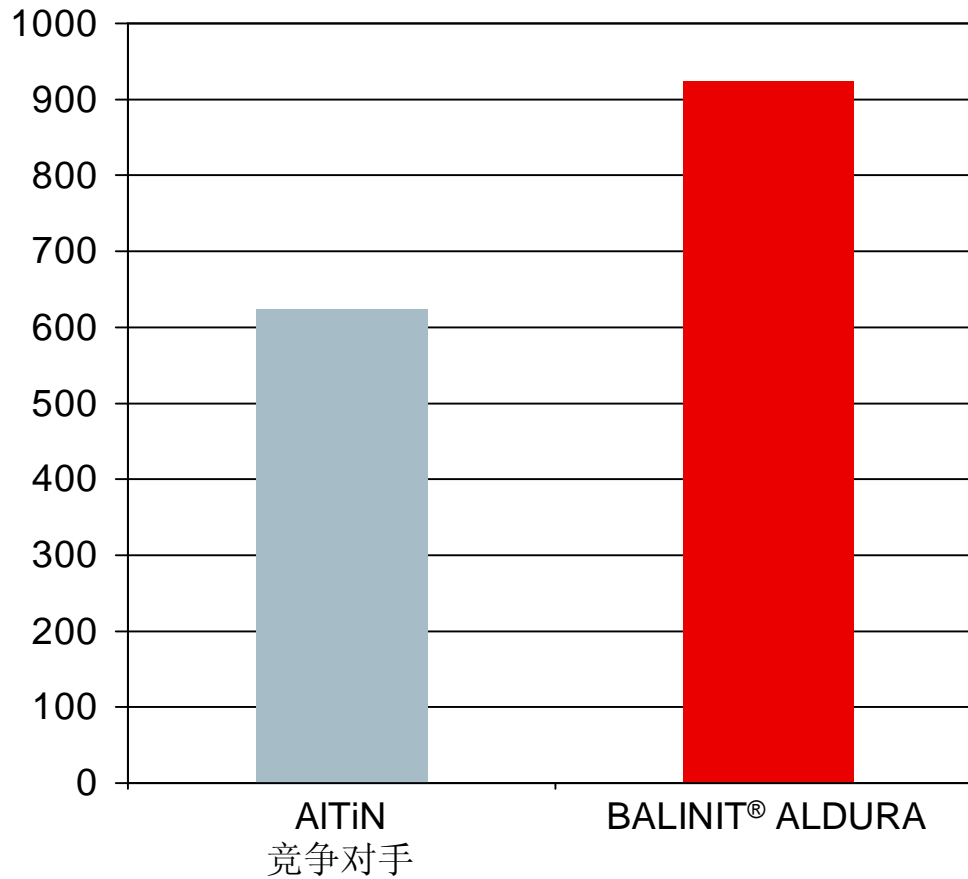
Source来源

Zecha, Germany德国



Contour milling of HRC 60 steel 成型铣削HRC60钢材

Cutting length 切削长度 [m]



Tool 工具

Ball nose end mill 球头铣刀, D = 10 mm

Workpiece 工件

Steel 钢 DIN 1.2379 (~AISI D2 / SKD 11)

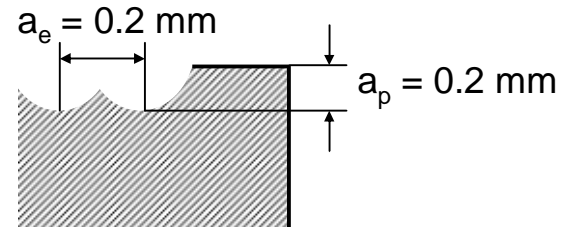
Cutting data 切削参数

$v_c = 170$ m/min

$f_t = 0.1$ mm

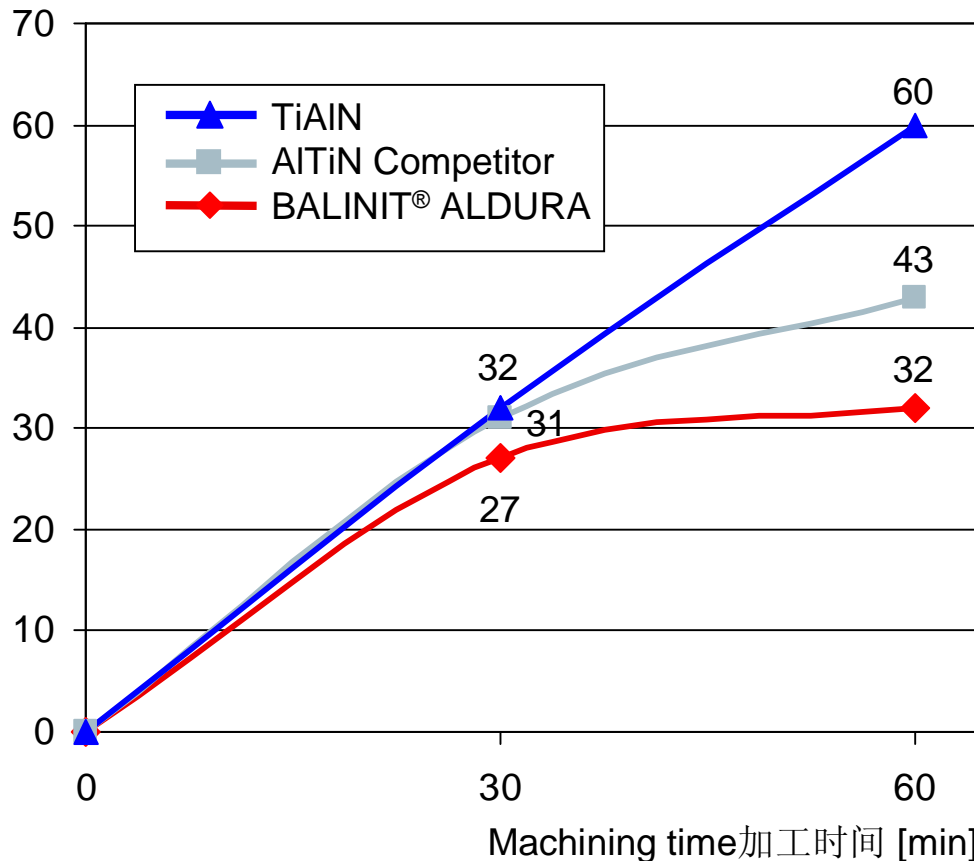
$VB_{max} = 0.15$ mm

Dry 干



Side milling (finishing) of HRC 60 steel 边洗（精加工）HRC60钢材

Flank wear后刀面磨损 [μm]



Tool工具

End mill立铣刀, D = 8 mm

Workpiece工件

Steel钢 DIN 1.2379 (~AISI D2 / SKD 11)

Cutting data切削参数

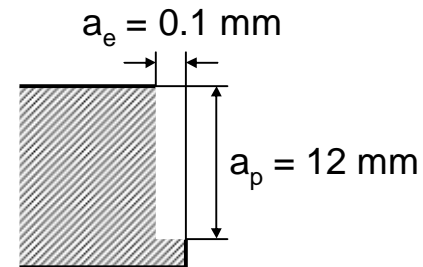
$v_c = 137 \text{ m/min}$

$n = 5425 \text{ rpm}$

Dry干

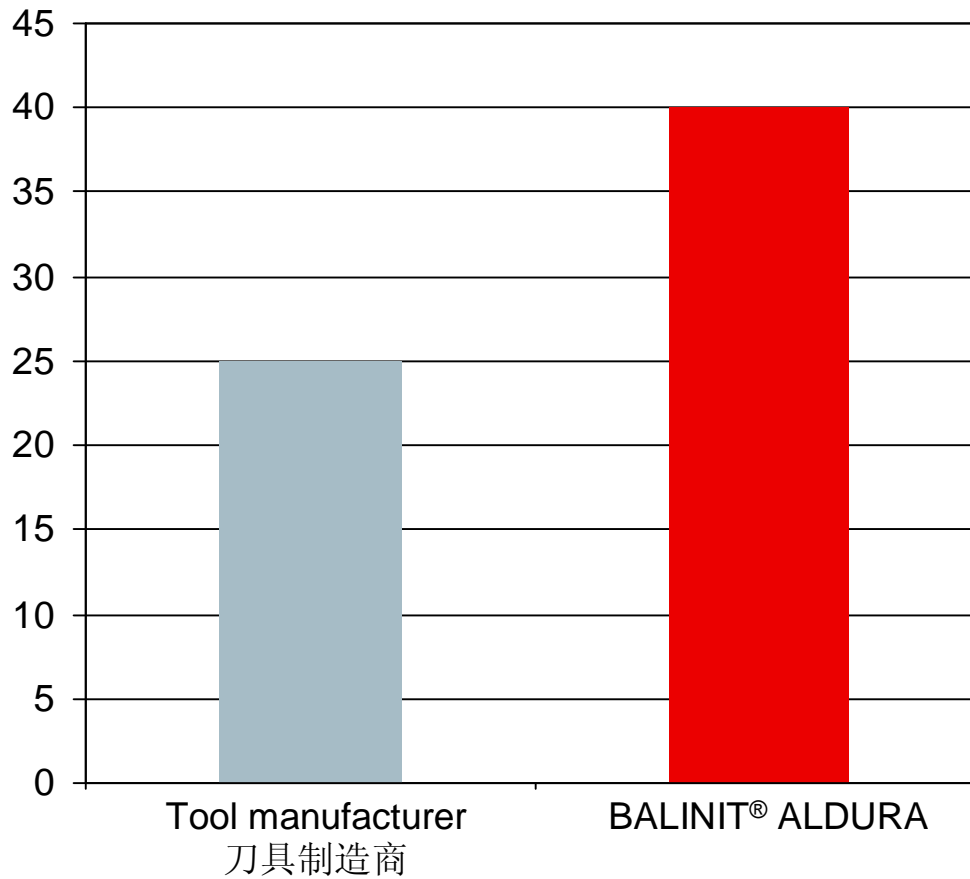
Source来源

DIXI Polytool SA / CH



Regrinding / Recoating 重磨/重涂

Tool life 工具寿命 [m]



Tool 工具

Carbide ball nose end mill 硬质合金球头铣刀,
regrind 重磨 D = 10 mm x 80L / 2Z

Workpiece 工件

NAK-80 (HRC 62)

Cutting data 切削参数

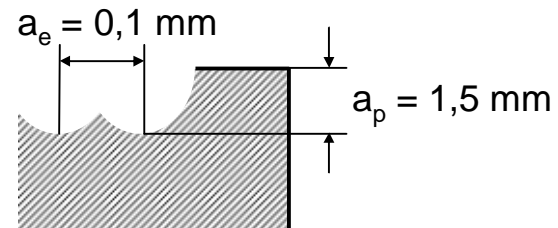
$v_c = 180$ m/min

$f_t = 0,02$ mm

Trocken 干

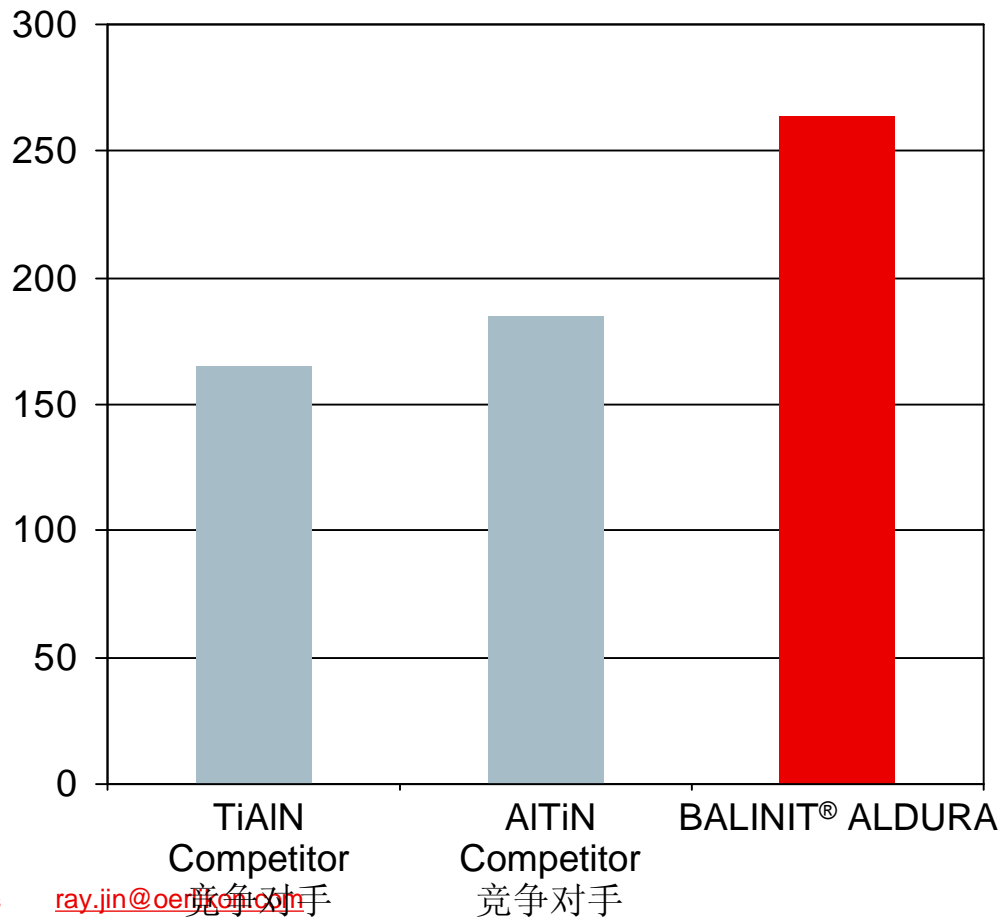
Source 来源

Regrinder, Japan 日本重磨商



Rough milling of HRC 52 steel 粗铣HRC52钢材

Cutting length 切削长度[m]



Tool工具

Ball nose end mill球头铣刀, D = 10 mm

Workpiece工件

Steel 钢DIN 1.2344 (~AISI H13 / SKD 61)

Cutting data切削参数

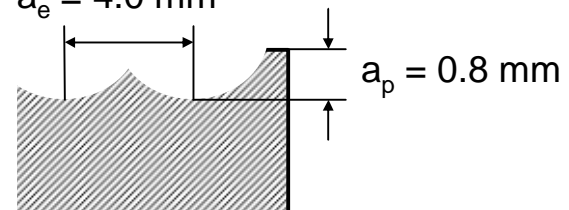
$v_c = 80$ m/min

$f_t = 0.15$ mm

$VB_{max} = 0.2$ mm

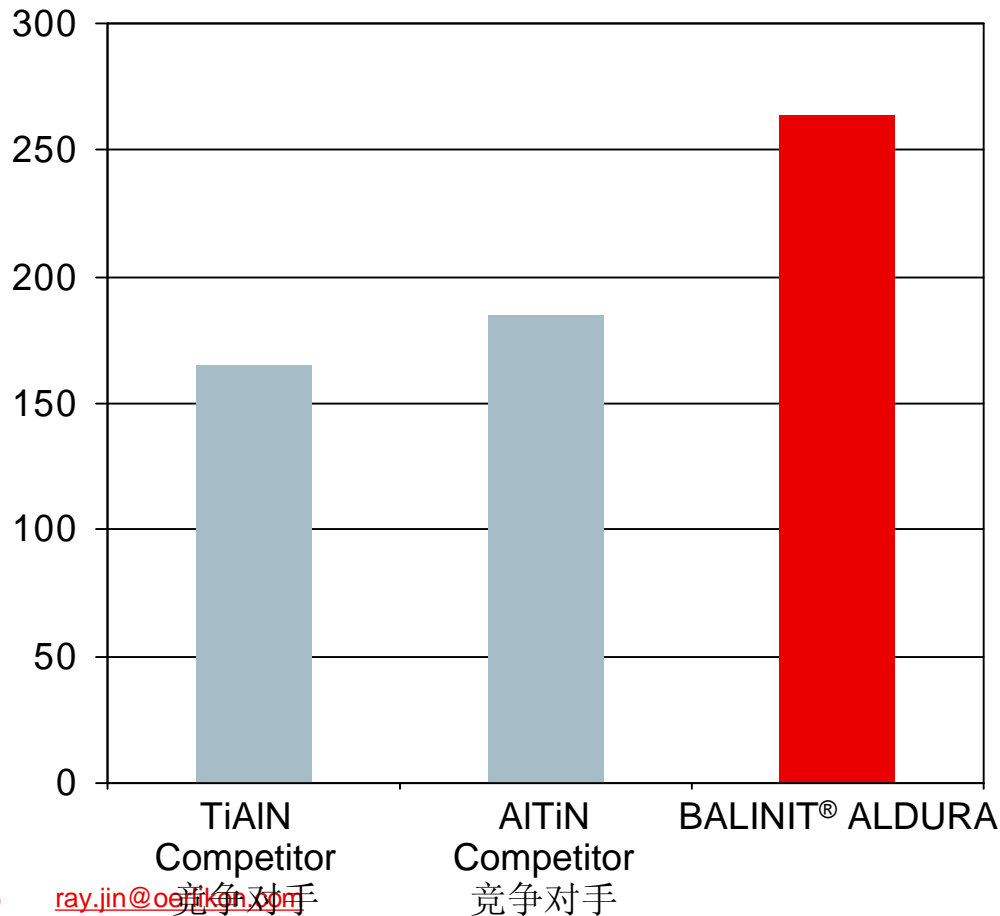
Dry干

$a_e = 4.0$ mm



Rough milling of HRC 45 steel 粗铣HRC45号钢

Tool life 工具寿命 [m]



Tool 工具

Ball nose end mill 球头铣刀, D = 10 mm

Workpiece 工件

Steel 钢 DIN 1.2344 (AISI H13 / SKD 61))

Cutting data 切削参数

$v_c = 170$ m/min

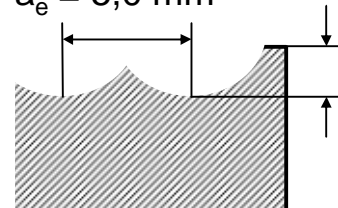
$f_t = 0,08$ mm

VB = 0,12 mm

6 % emulsion 润滑

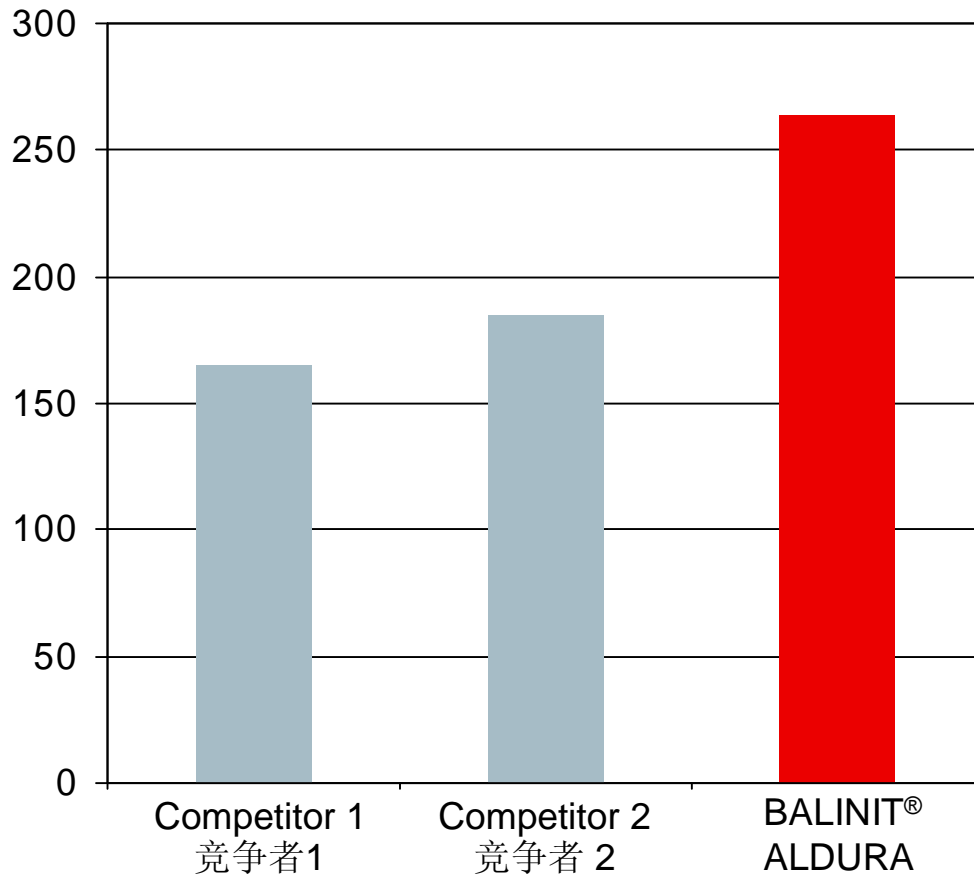
$a_e = 5,0$ mm

$a_p = 1,0$ mm



Milling of TiAl6V4 铣削TiAl6V4

Tool life 工具寿命 [m]



Tool 工具

Ball nose end mill 球头铣刀, D = 6 mm

Workpiece 工件

TiAl6V4 (DIN 3.7165)

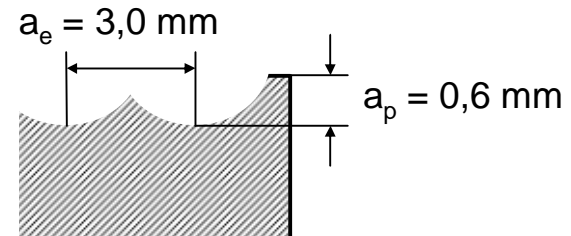
Cutting data 切削参数

$v_c = 120$ m/min

$f_t = 0,08$ mm

VB = 0,12 mm

6 % emulsion



Enhanced productivity and process reliability 提升产量和工艺的稳定性

- § BALINIT® ALDURA cuts your costs and turnaround times in hard cutting
- § BALINIT® ALDURA 降低您的成本和切削硬材料的生产周期

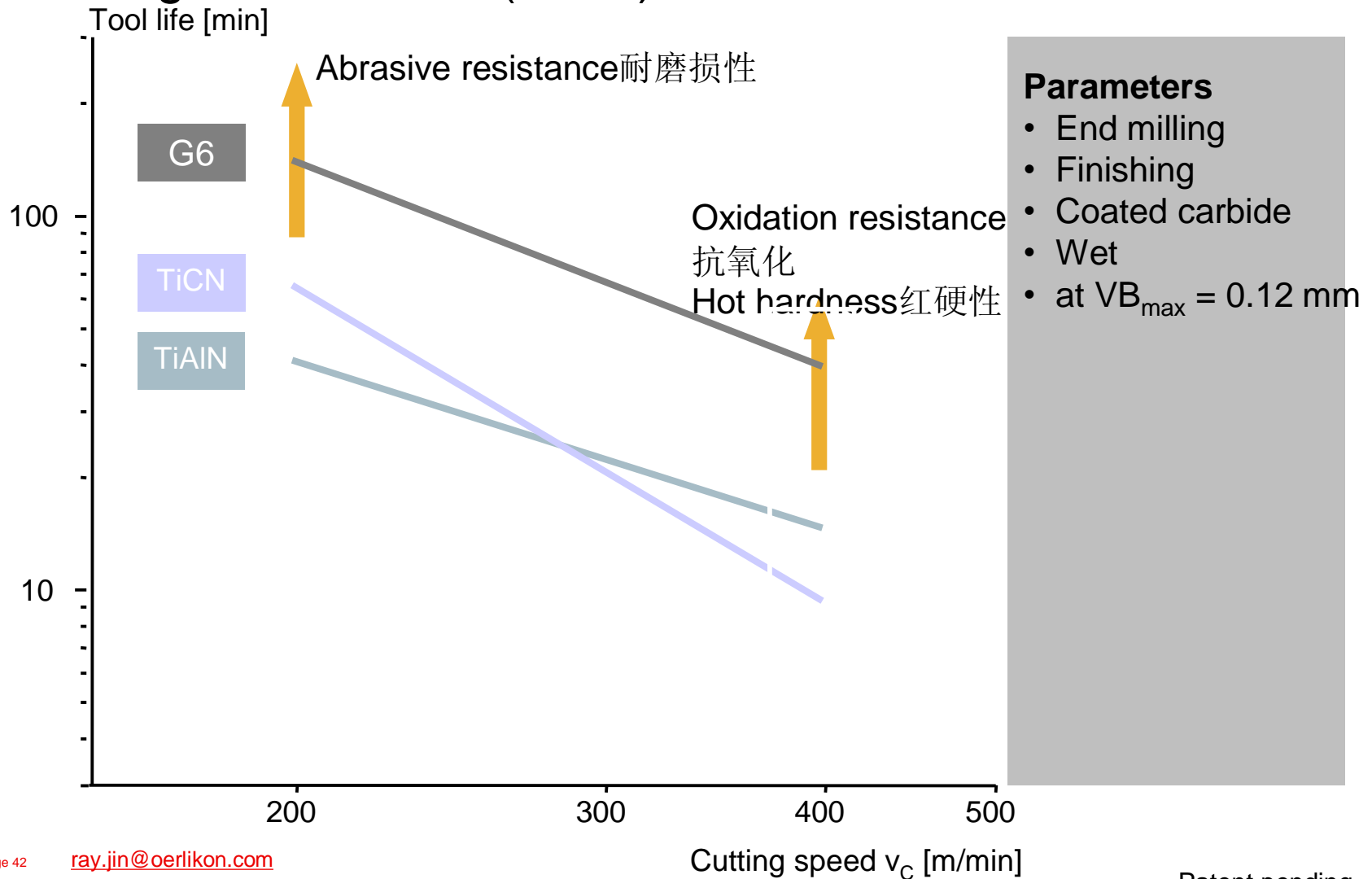
- § BALINIT® ALDURA ensured high process reliability and optimal quality in applications that involve difficult-to-machine materials
- § BALINIT® ALDURA 保证加工难加工材料时的高度工艺稳定性和优化的质量

- § Recoatability of BALINIT® ALDURA-coated tools without loss of performance
- § BALINIT® ALDURA 涂层过的工具可重涂，并且不会降低其性能

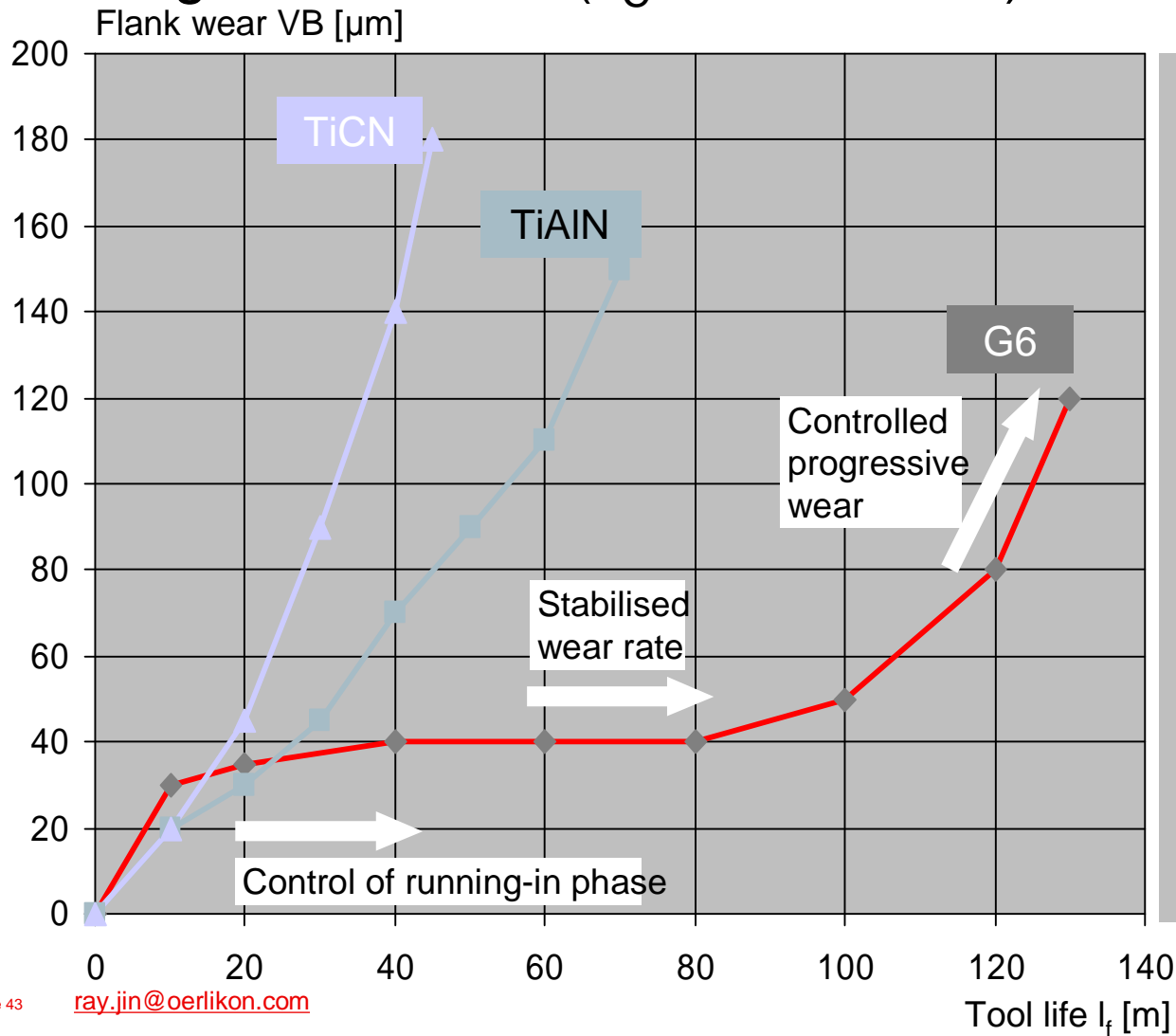
**BALINIT® ALDURA –
your crucial competitive
advantage**
**BALINIT® ALDURA – 决定您的
竞争优势**



Finishing carbon steel (Ck45)



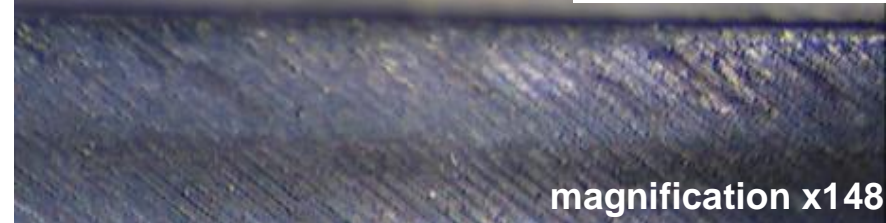
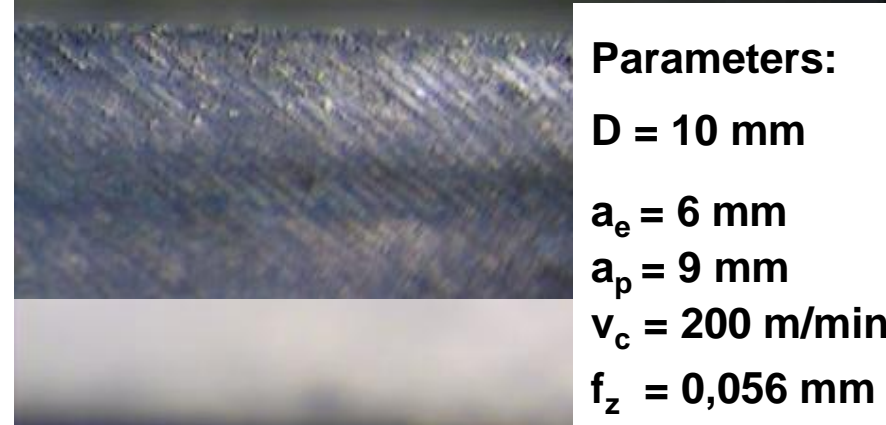
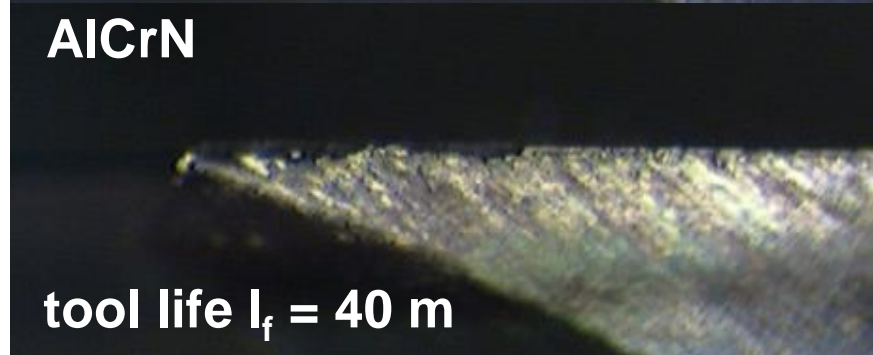
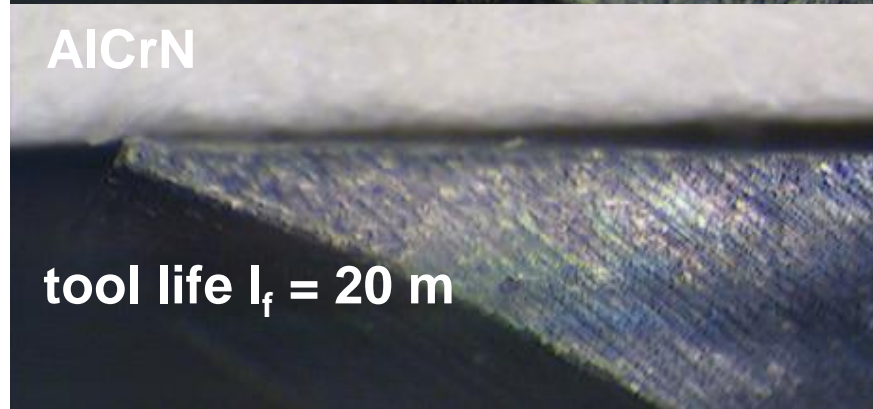
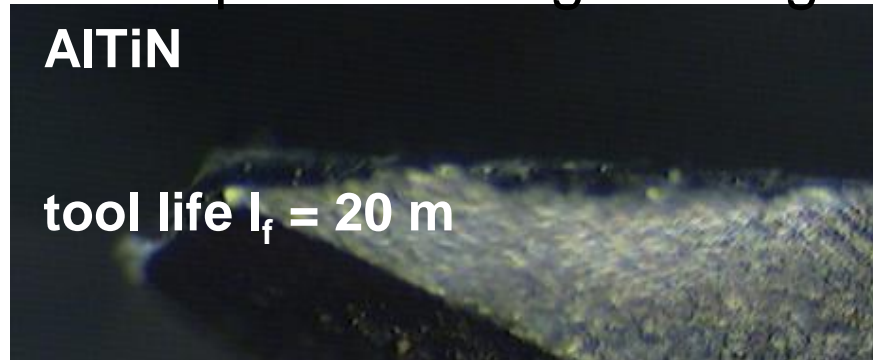
Finishing carbon steel ($v_C = 400$ m/min)



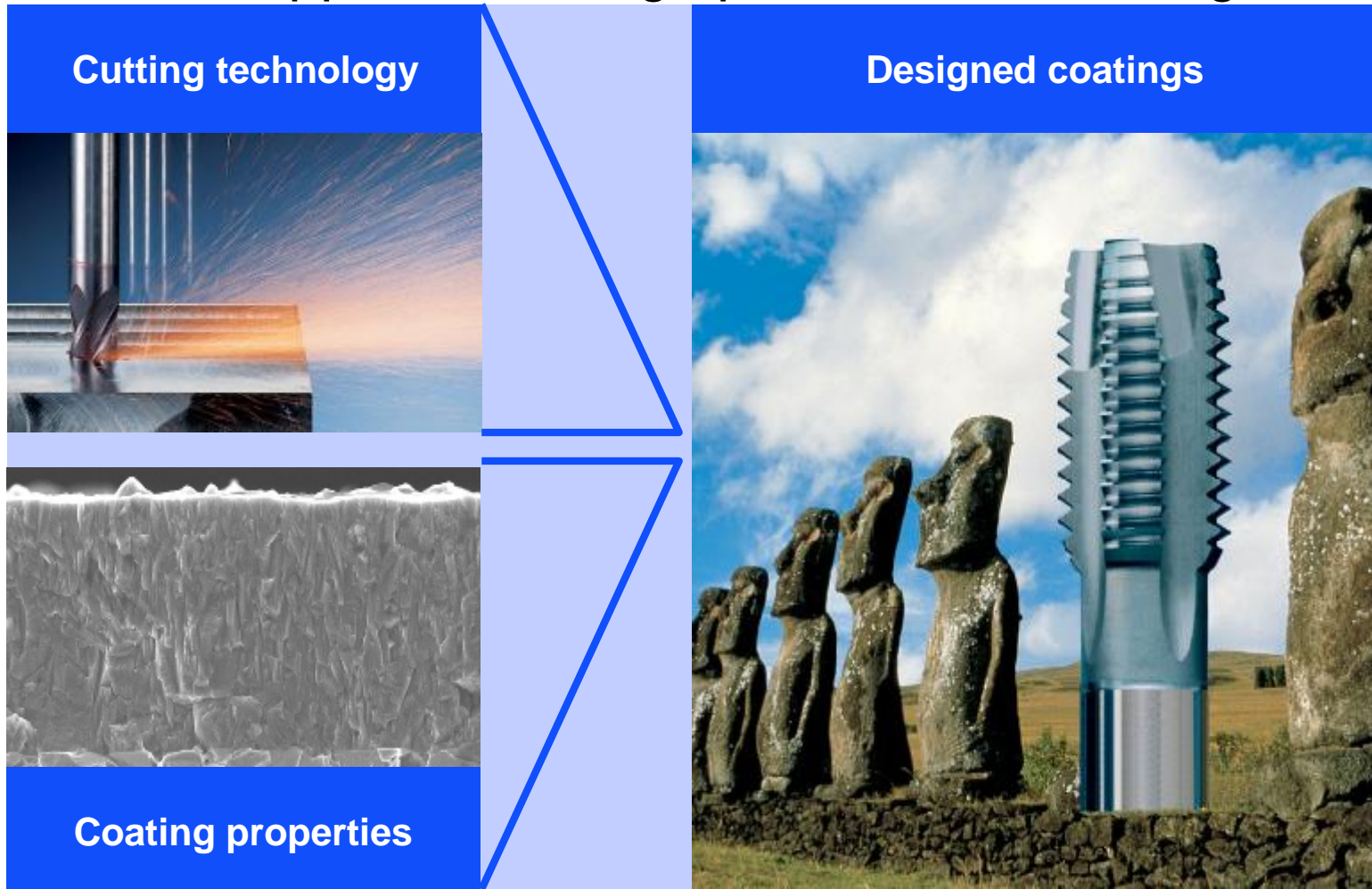
Parameters

- End milling 立铣刀
- Finishing 精加工
- Coated carbide 碳钢
- Wet 湿切

Wear pictures rough milling of carbon steel



Coating development:
Sophisticated approach for high performance coatings



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Thank you for your attention ...



...do you have some questions?