
高耐磨高耐蝕螺桿鋼材特性與應用

梧濟工業股份有限公司

信昌精密模具(上海)有限公司

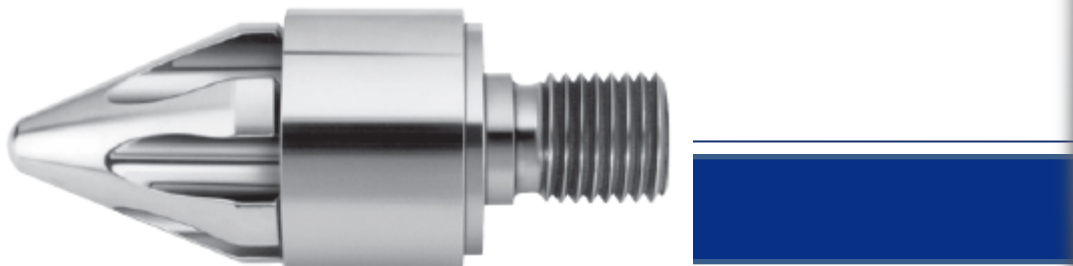
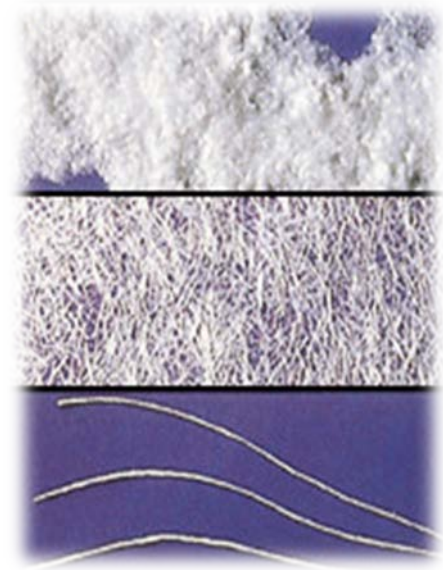


主講者：鄭富丰

INJECTION SCREW

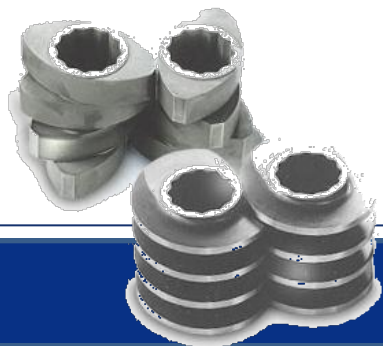
螺桿&螺桿結 常見問題：

- 阻燃劑
 - 具腐蝕性(酸性)
- 玻璃纖維(Glass-Fiber)
 - 具磨耗性



何謂無鹵素(Halogen Free)?

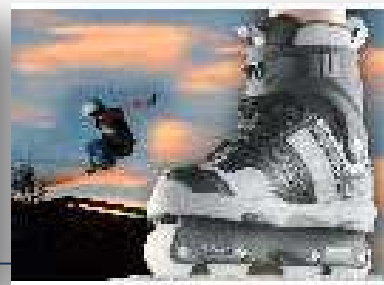
- Halogen Free即無鹵素的意思，業界亦有叫低煙無鹵的。
- 無鹵素技術是指所使用的零件、塗料、製程都不含鹵素，因為含溴系與氯系之聚合物在燃燒或加熱過程中會釋放有害物質。
- 戴奧辛跟鹵酸、鹵素對人體的免疫系統具有毒害的作用，如果不慎吸入煙霧跟戴奧辛的話，有可能會導致窒息死亡或致癌的機會，而且其會持久的累積在生物體內，**聯合國環境規劃總署**並已列入持久性有機污染物。



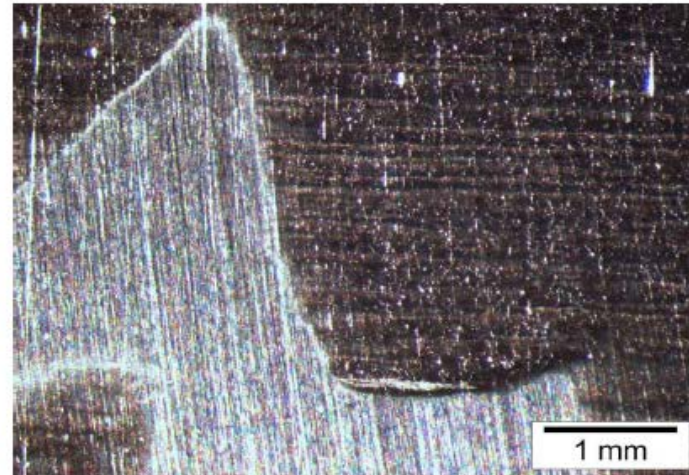
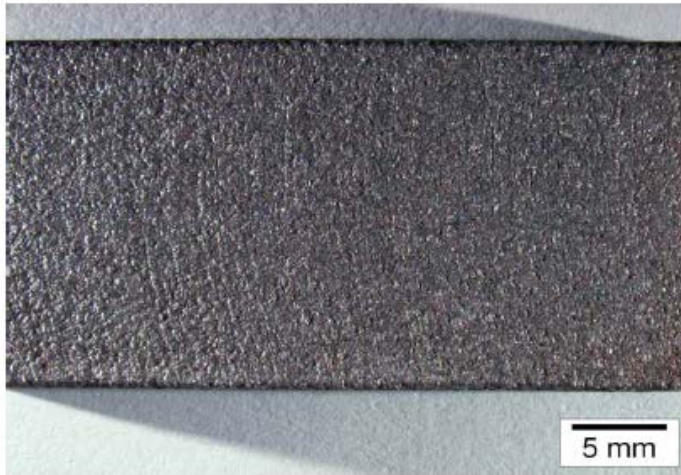
資料來源：Greenpeace International

無鹵素材料產品

- 而一般電子零件物品也會因為鹵酸的浸蝕而無法再次利用，減少零件再使用的機會。
- 『無鹵素材料產品』已經是日前最新的環保趨勢，國際大廠包括ASUS、Dell、HP、Apple、Intel、AMD等公司聲明將自2008年開始導入無鹵素材料。
- 國際間將陸續掀起訂定無鹵素產品限制使用的相關法律，故無鹵素材料的不斷地開發，連帶引發進料後相關的品管檢測機制，使無鹵素材料的導入已經成為國際間各大廠下一階段的綠化目標。



Uniform Corrosion

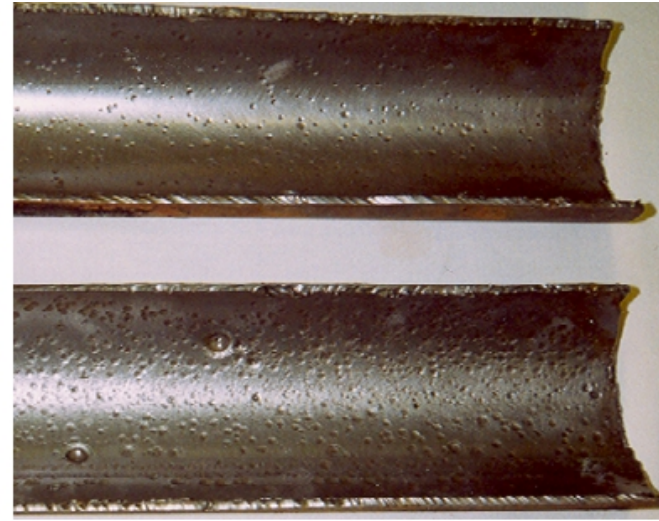
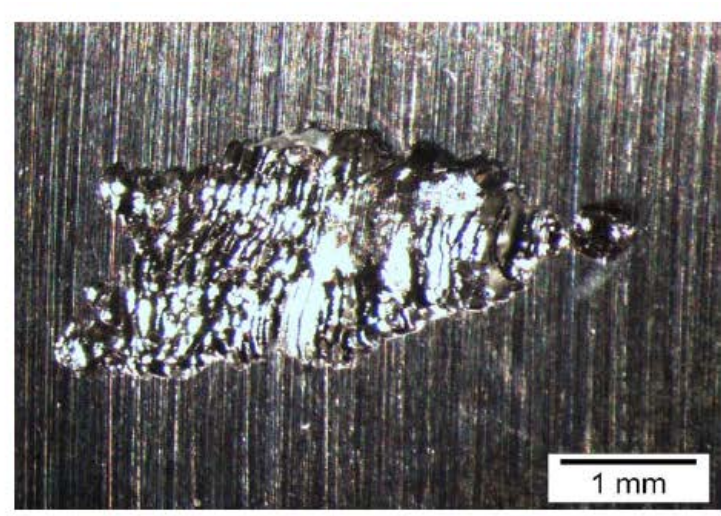
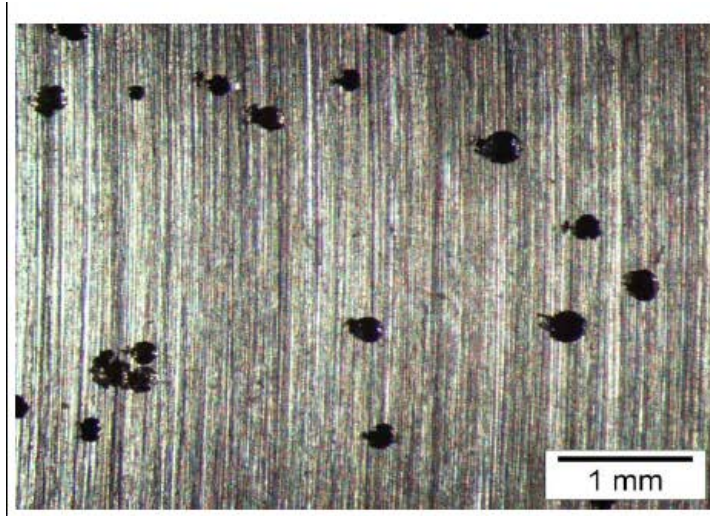


Resistance
Mass Loss
Resistance
Usability

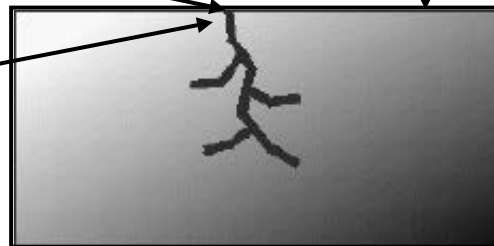
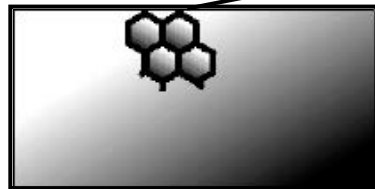
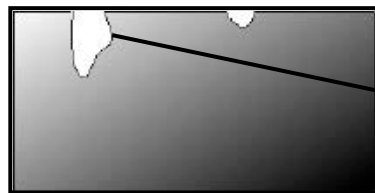
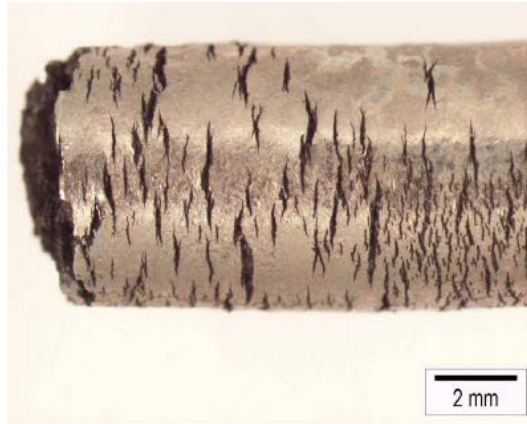
= f(Cr-, Mo-content) of the material
 $1 \text{ g/m}^2\text{h} \approx 1 \text{ mm/a}$ (only for steel)
Attack $< 0.1 \text{ mm/a}$
Attack $< 1 \text{ mm/a}$



Pitting Corrosion



Stress Corrosion Cracking



Impact force

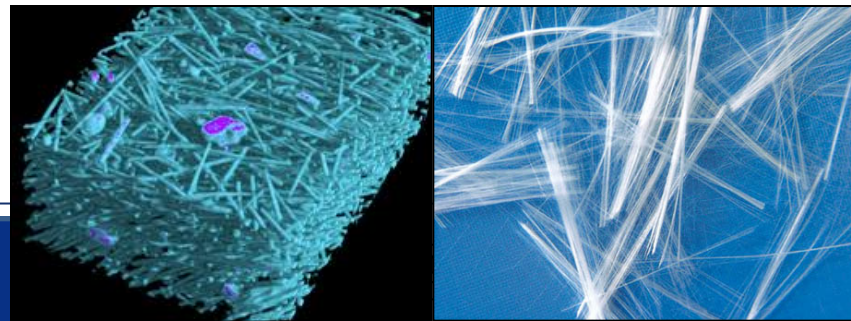
Pitting and Intergranular Corrosion possible Crackstarter



玻璃纖維

●近年來工業益加發達，所要求材料之性能亦各不同，如**要求輕重量、高強度、高溫、高強度、磨擦係數較小、耐磨耗佳、導電性良而耐熔著性或耐蝕性佳**、或其他單一材料無法達到的特殊性能，而需要**結合應用兩種以上的材料**，故有**不同類型之「複合材料」**出現，此種經組合之新材料，能兼具原有材料之特性及相輔性之優點，用途甚廣。

→**混料機、造粒機與塑膠射出成型機因鹵素、無鹵素及添加了玻璃纖維之原料，其原料極具腐蝕性(酸性)及磨耗性，往往會加速損壞螺桿、螺桿結、料管與止逆環等重要的零件與模具，故鋼材的耐腐蝕性與耐磨耗性就更顯得重要了。**



Abrasive Wear

Erosion of the Matrix

刮損磨耗：
基地熔損，熔蝕現象

對策：
強化基地硬度與
碳化物硬度

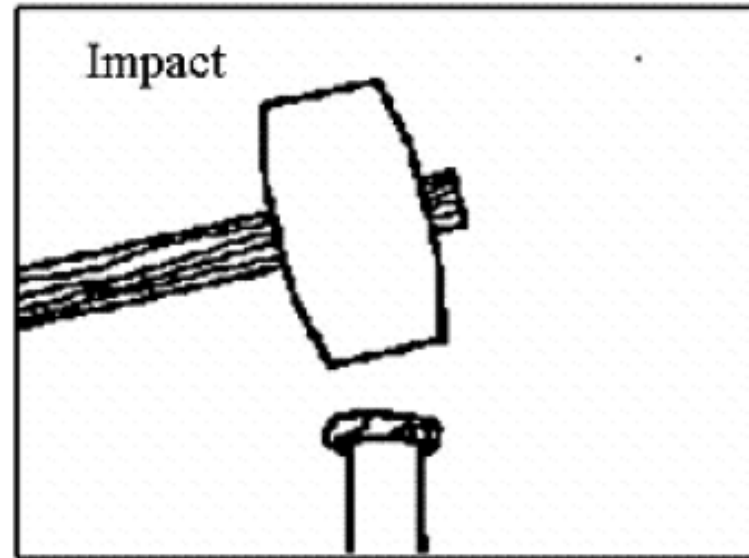
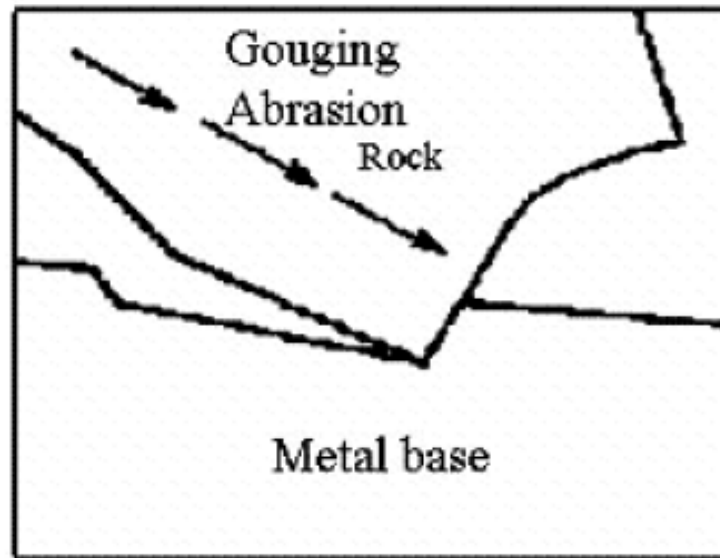
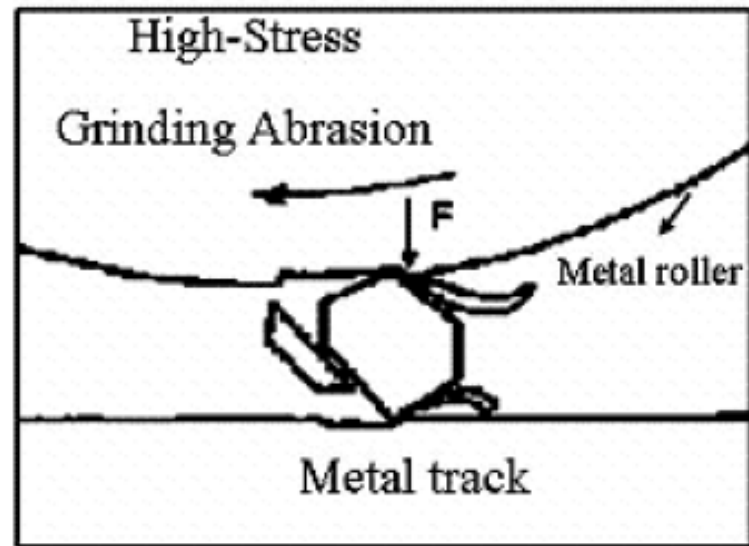
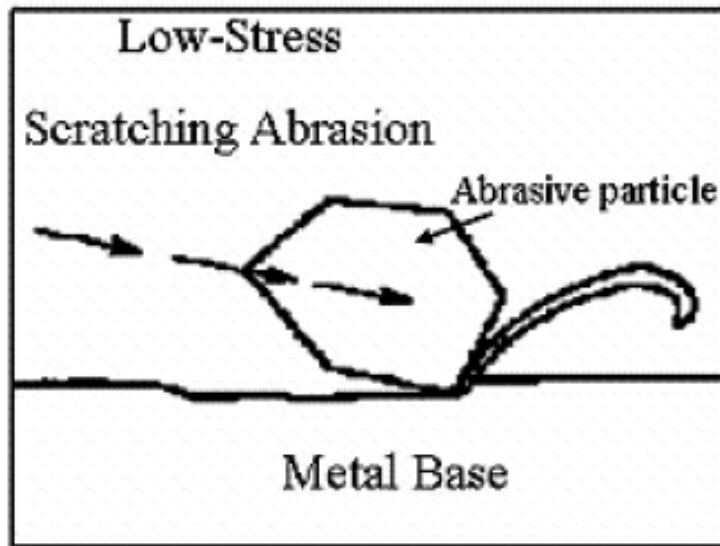
Tribooxidation

Chemical Reaction
Tool - Workpiece
Lubricant / Coolant

Increased Matrix Strength
Hard Particles (Carbides)



基地熔蝕
Erosion of the Matrix



鋼材--耐磨耗性能

- 元素影響---- C、Cr、W、V、CO
- 熱處理工藝----調整材料韌性及耐磨耗性
- 碳化物當量及碳化物種類

鋼材--耐蝕性能

- 元素影響---- N、Ni、Cr、Mo
- 熱處理工藝----高溫及低溫區別
- 表面狀態----光滑表面耐蝕能力佳

Grade	C	Cr	Mo	V	Others
BÖHLER M 340	0,54	17,0	1,1	0,1	N
440B (1.4112)	0,9	17,5	1,1	0,1	

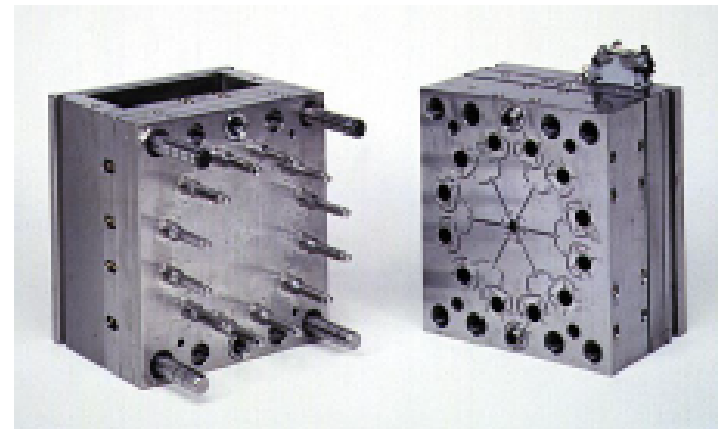
Small and Medium Moulds
or Inserts
Wear resistant,
Corrosion resistant
17 % Cr-Mo-V -Steels

BÖHLER M340
ISOPLAST®

ESR -Quality
53 -58 HRC

抗30%G/F耐磨+耐蝕鏡面不銹鋼

Performance	Core	Mould-Insert
18 – 20 Mio. pcs. Corrosion at Inserts ⇒ Scrap	1.2083 ESU (52 HRC)	1.2343 (55 HRC)
8 – 10 Mio. pcs. Remarkable Wear ⇒ Scrap	1.2083 ESU (50 – 52 HRC)	1.2083 ESU (50 – 52 HRC)
18 – 20 Mio. pcs. No Corrosion No Wear ⇒ Reground	BÖHLER M340 ISOPLAST® (52 HRC)	BÖHLER M340 ISOPLAST® (52 HRC)



Plastic mould for disposable drip chambers

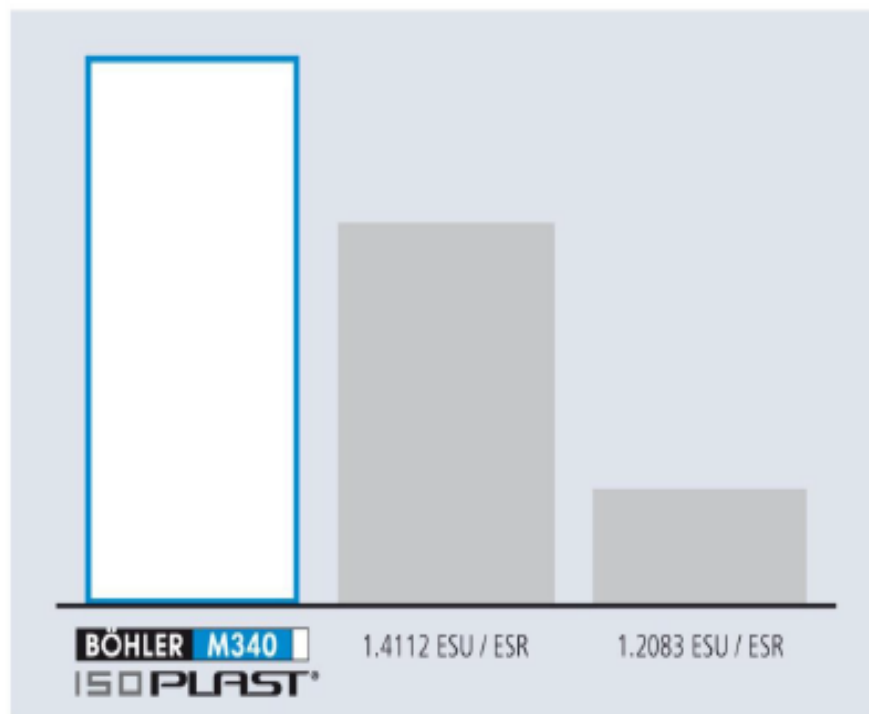
Plastic: soft PVC (Resil FMM 871 NT01)

抗30%G/F耐磨+耐蝕鏡面不銹鋼

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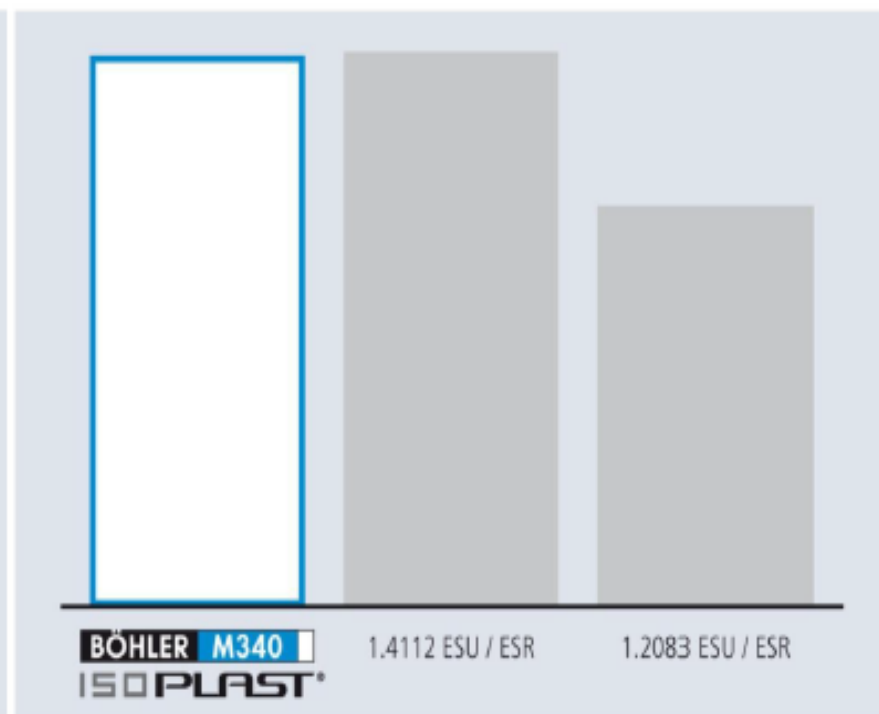
Korrosionsbeständigkeit / Corrosion resistance*



Wärmebehandlung mit niedriger Anlasstemperatur /
Heat treatment with low tempering temperature

* Vergleich ist schematisch / Schematic comparison

Verschleißbeständigkeit / Wear resistance*



Wärmebehandlung mit hoher Anlasstemperatur /
Heat treatment with high tempering temperature

NB-A/B件 抗高玻纖G/F 高耐磨、高耐蝕性鋼材

Grade	C	Cr	Mo	V	Others
BÖHLER M 390	1,9	20	1	4	W 0,6

Small and Medium Moulds Screws
 Highly wear resistant,
 polishable, stainless
 High C - CrMoV-Steels

BÖHLER M390
MICROCLEAN

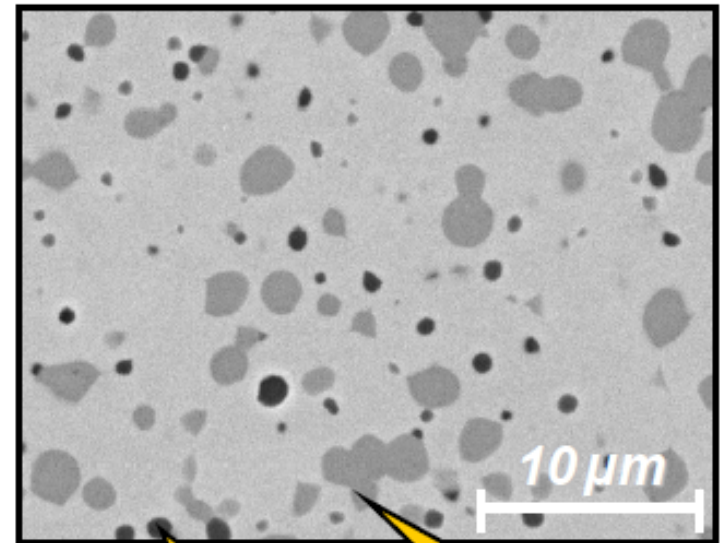
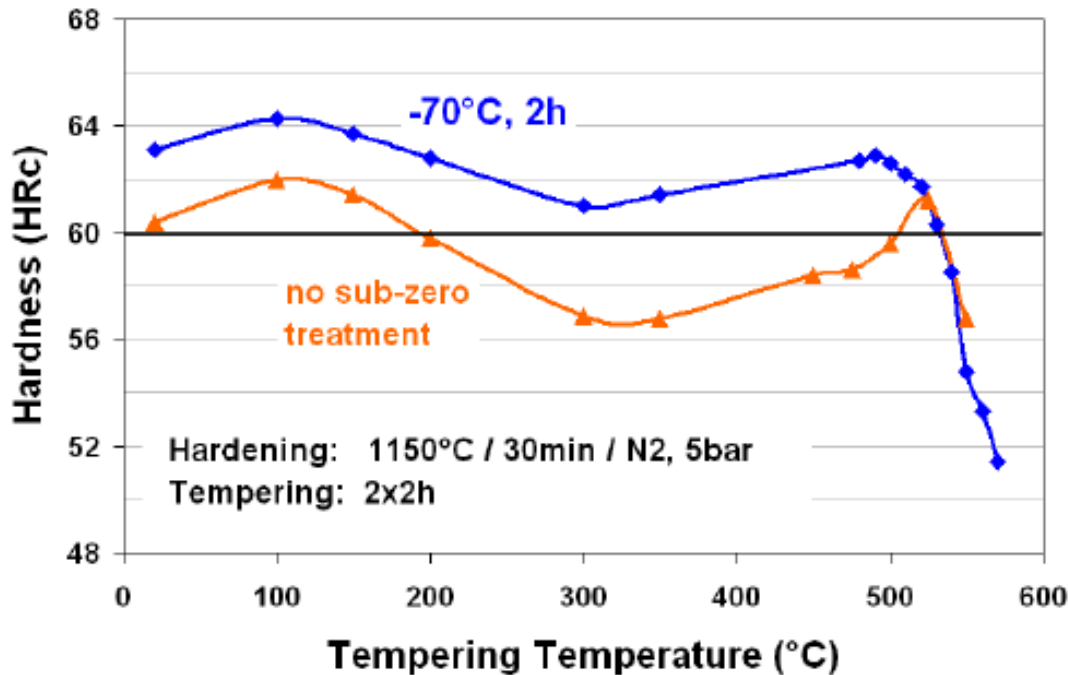
PM-Quality
56 -62 HRC

抗50%G/F耐磨+耐蝕鏡面不銹鋼

Chemical composition (average %)

C	Si	Mn	Cr	Mo	V	W
1.90	0.70	0.30	20.00	1.00	4.00	0.60

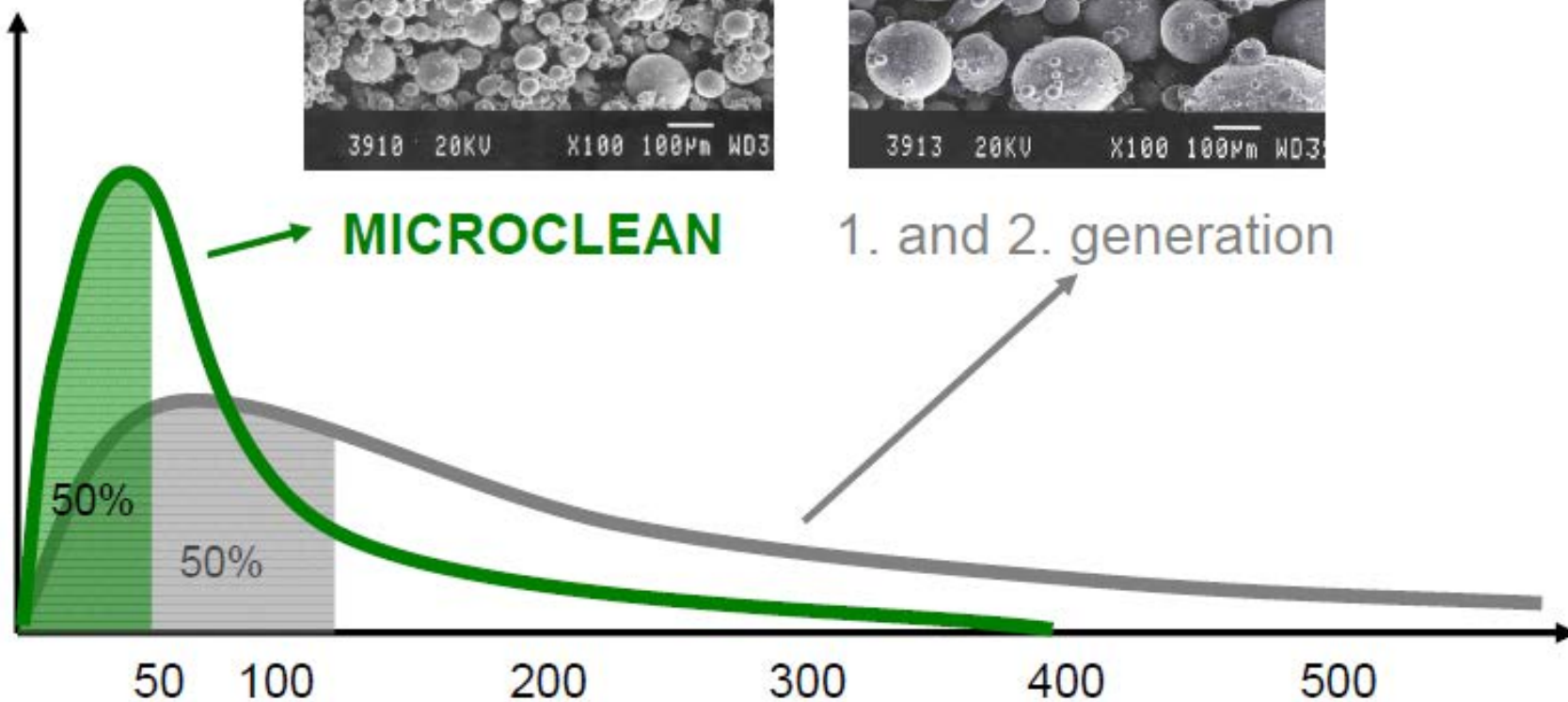
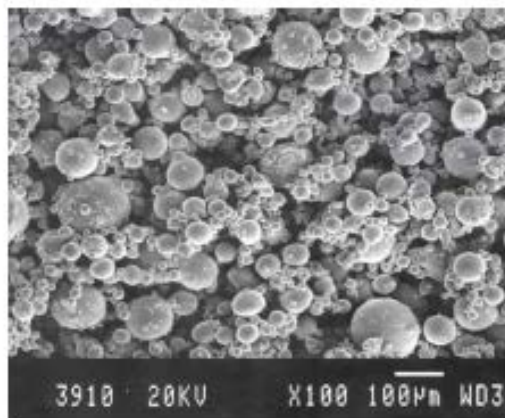
BÖHLER M390
MICROCLEAN®



~2,5% MC

~18% M₇C₃

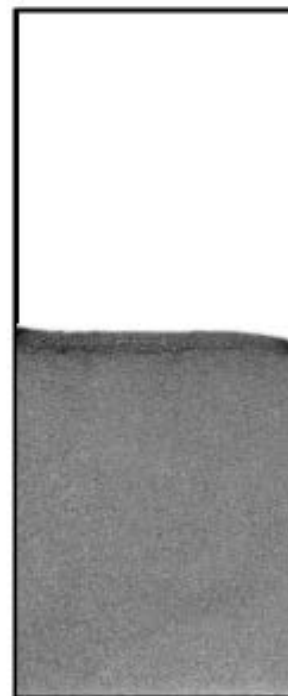
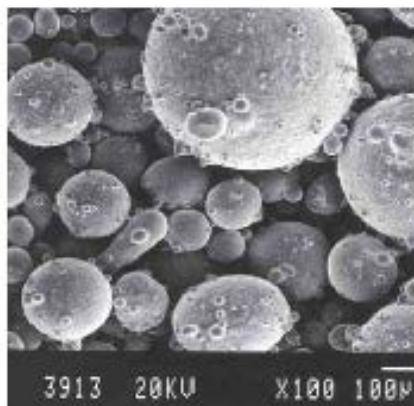
抗50%G/F耐磨+耐蝕鏡面不銹鋼



powdersize

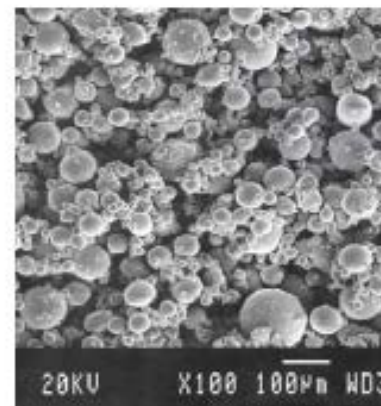
1. + 2. Generation

Coarse powder



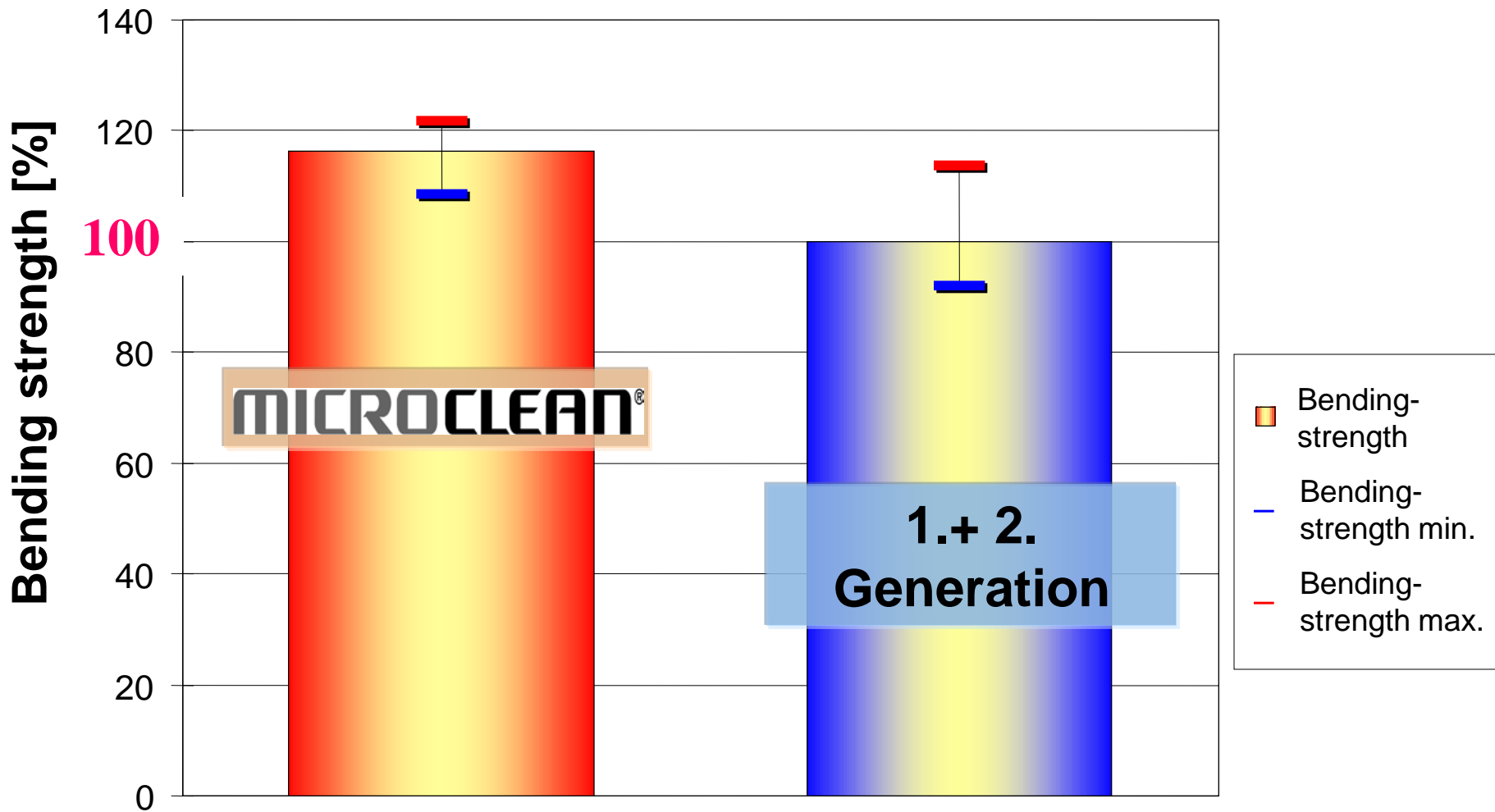
MICROCLEAN[®]

Fine powder



A fine powder gives a more uniform and homogenous filling result

Bending strength

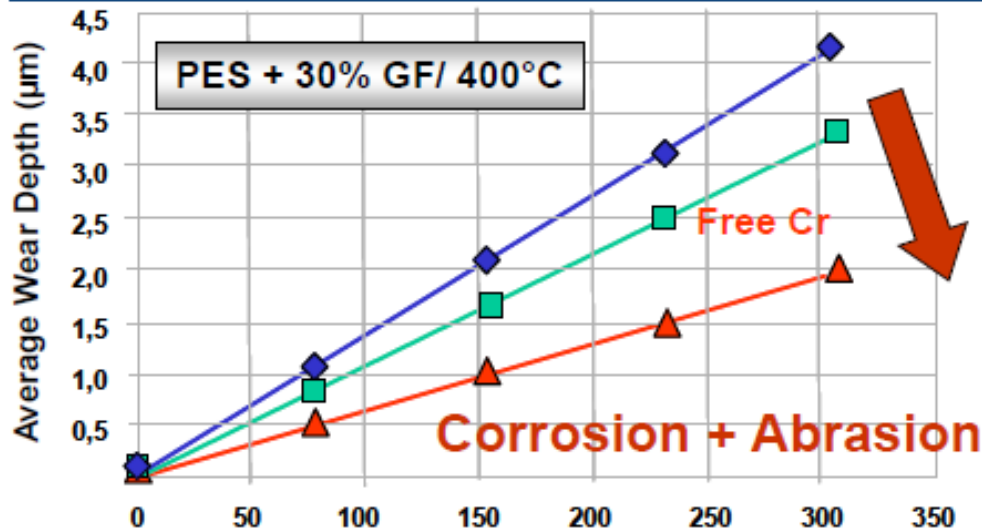


梧濟樣品檢測比對

耐鹵素腐蝕測試 2012-0101

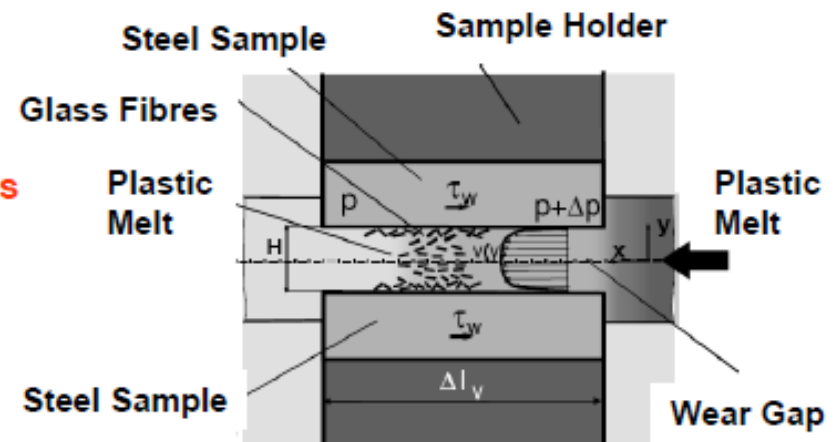
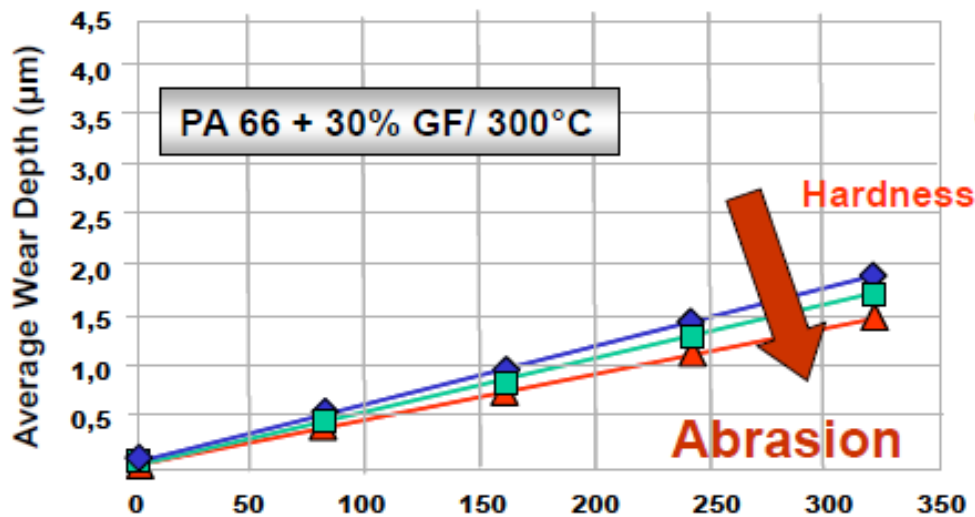
合金材料編號	M390	CPM 420V	K340
硬度(熱處理前)HRC	264	290	270
硬度(熱處理後)HV	618~660	570~640	590~654
腐蝕率(熱處理後) mg/cm ² /hr	0.26	1.14	3.47
熱處理前 合金成分比例(%)—含量 0.1%以上成分			
C	1.86	2.34	1.37
Si	0.65	0.53	0.73
Mn	0.31	0.487	0.391
Cr	20.0	14.14	8.07
Ni	0.114	0.04	0.149
Mo	0.93	1.02	1.93
V	4.0	6.27	0.425
W	0.409	0.039	0.039
Fe	73.1	75	86.5

試驗方法:	耐化學藥品性-成品測試-重量損失率
試驗條件:	浸泡溶液: 10% 磷酸
	浸漬溫度: 40°C
	浸漬時間: 20 小時
	Specimen: 50 x 50 x 50 mm
	腐蝕率: 重量損失/表面積/浸漬時間



%	C	Cr	Mo	V	W
K110	1,55	11,80	0,80	0,95	
K190PM	2,30	12,50	1,10	4,00	
M390PM	1,90	20,00	1,00	4,00	0,60

Hardness	HRC
K110	58
K190PM	60
M390PM	61



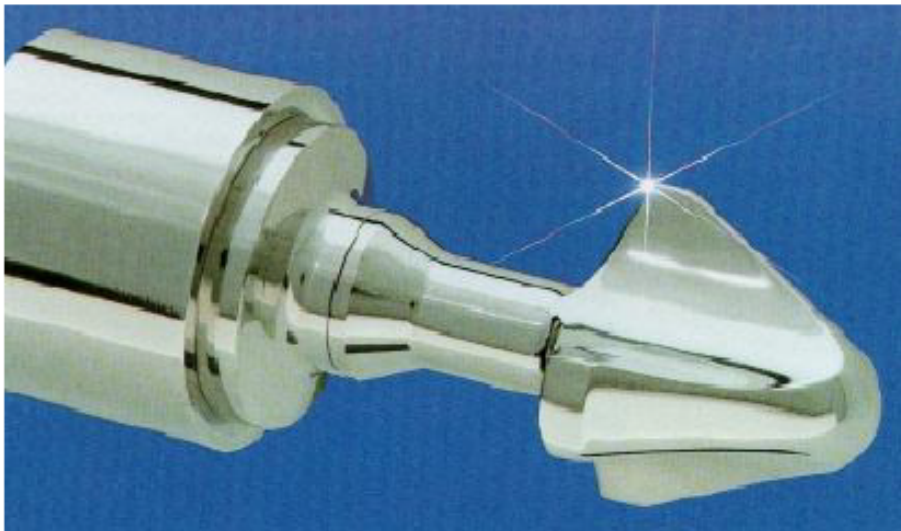
W. Friesenbichler*, G. R. Langecker*, D. Caliskanoglu**

抗50%G/F耐磨+耐蝕鏡面不銹鋼

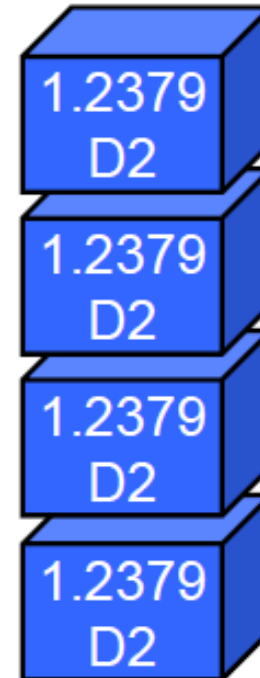
Injection moulding – non return valve

Process: Injection moulding of glass fibre reinforced thermosetting plastic (20% glass fibres)

Problem: wear and corrosion



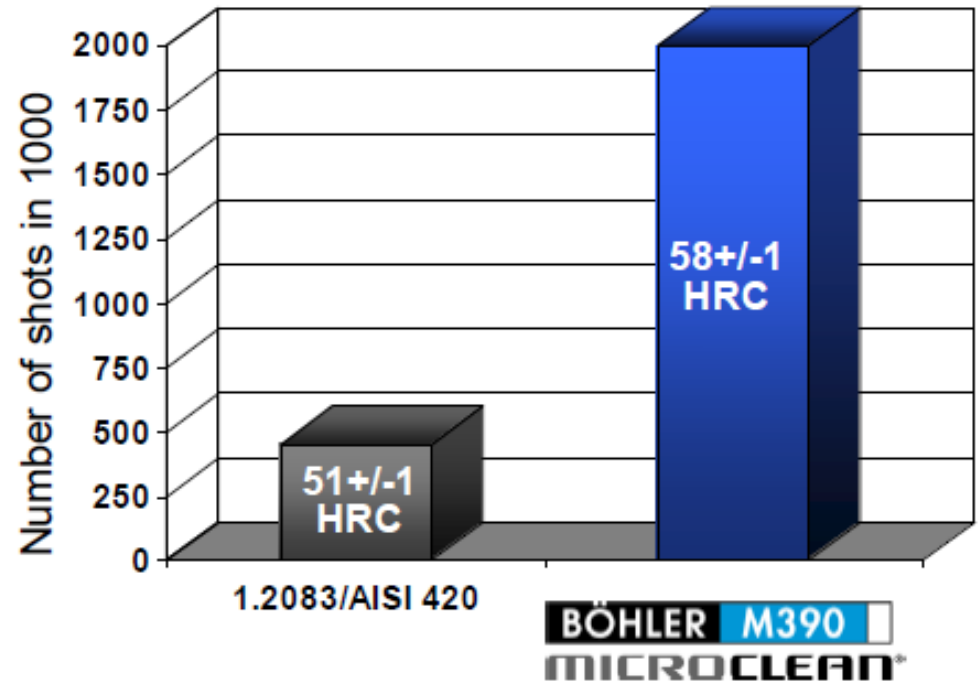
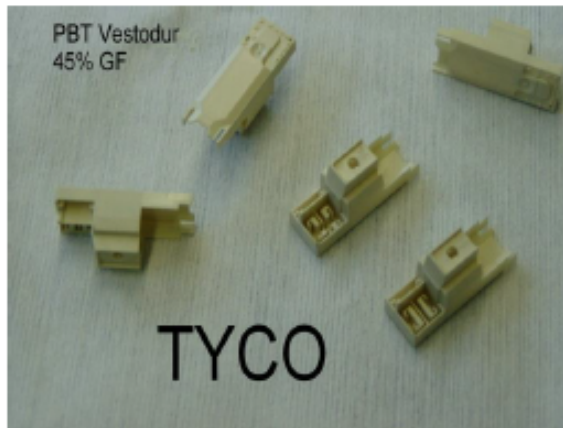
SKD-11



Tool life

抗50%G/F耐磨+耐蝕鏡面不銹鋼

Injection moulding – base plates for relays



Processed material:

PBT Vestodur X7212 NF + 45% GF

Cause for tool damage:

Wear

抗50%G/F耐磨+耐蝕鏡面不銹鋼



BÖHLER M390
MICROCLEAN®

Stock Dimensions

Rounds: 12,5 -206 mm
Flats: 202 x 50,8 mm
302,5 x 30,8 -50,8 mm

Forged Blocks:
FL 373 x 343 mm



抗50%G/F耐磨+耐蝕鏡面不銹鋼

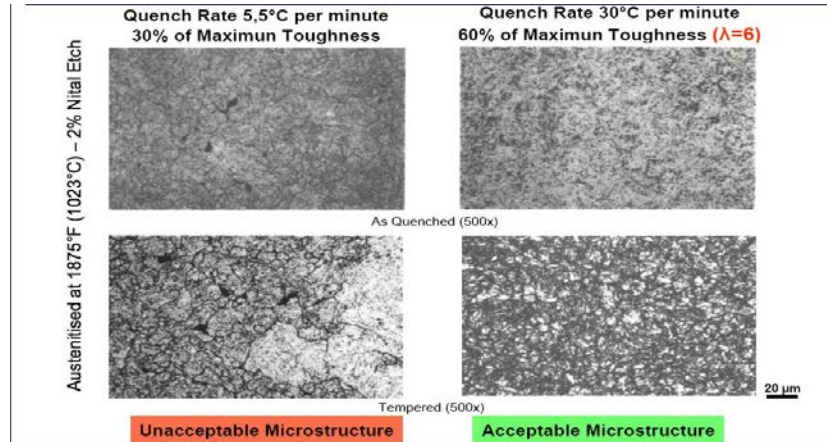
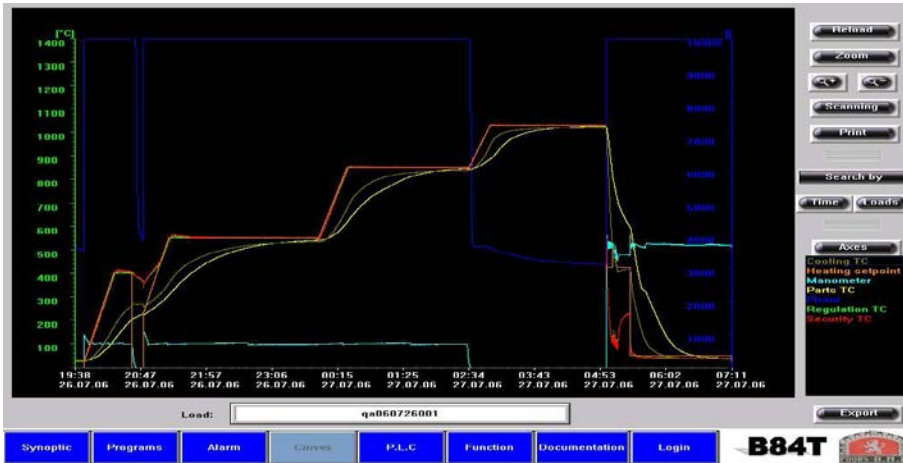
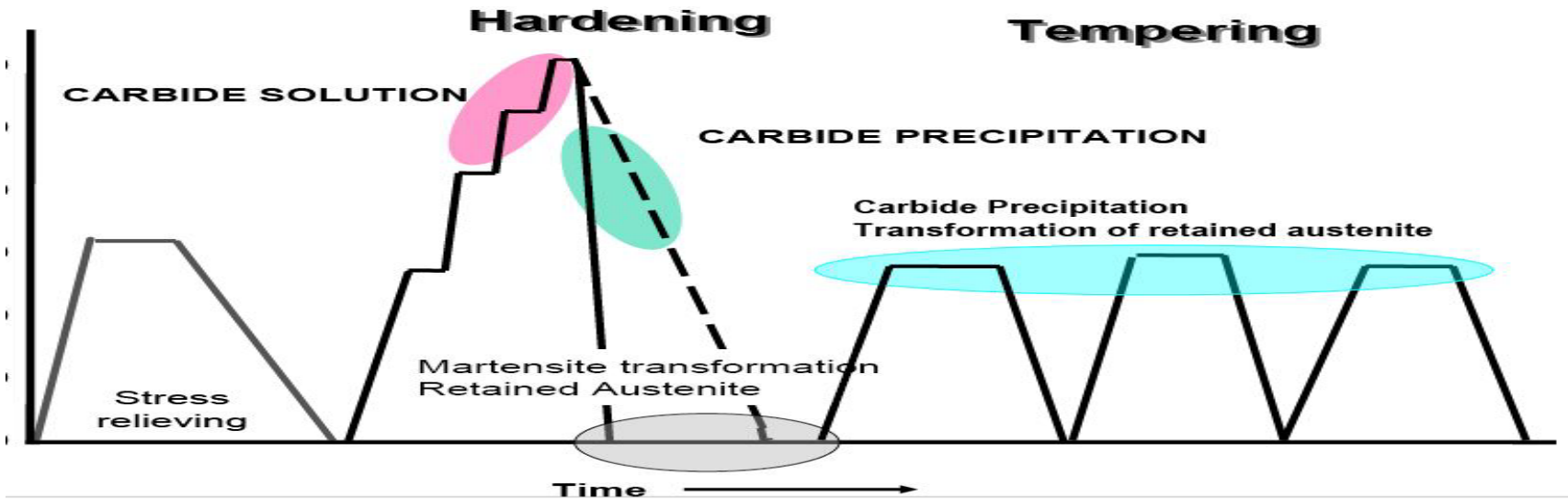


抗50%G/F耐磨+耐蝕鏡面不銹鋼

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熱處理工藝對磨耗性、耐蝕性影響

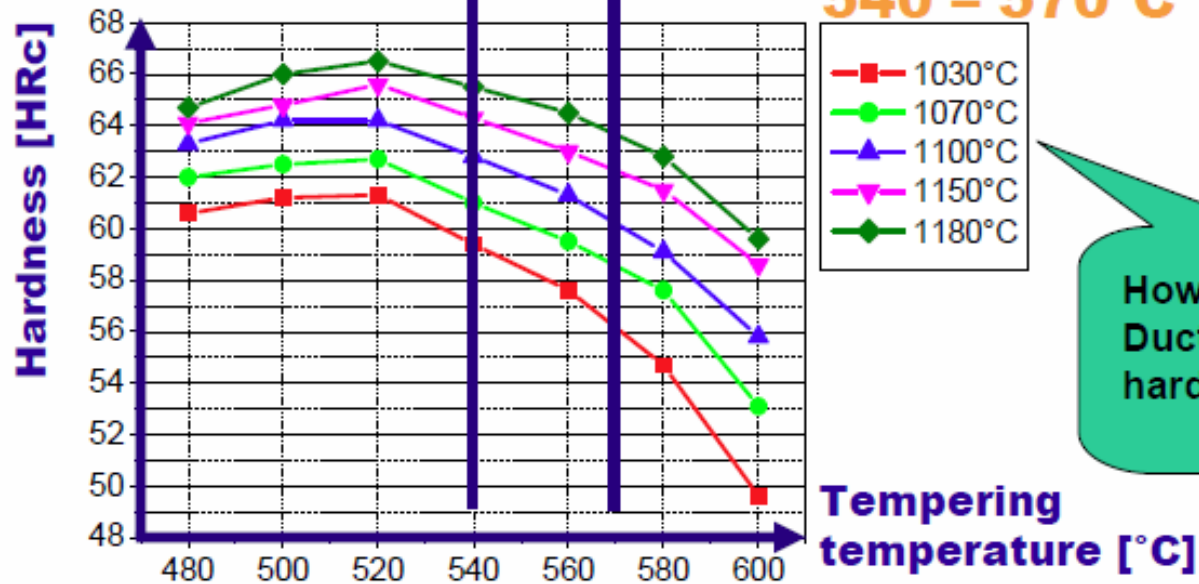
熱處理流程意識圖



„Special Materials need unique and Tailored Heat Treatment“

BÖHLER K890
MICROCLEAN®

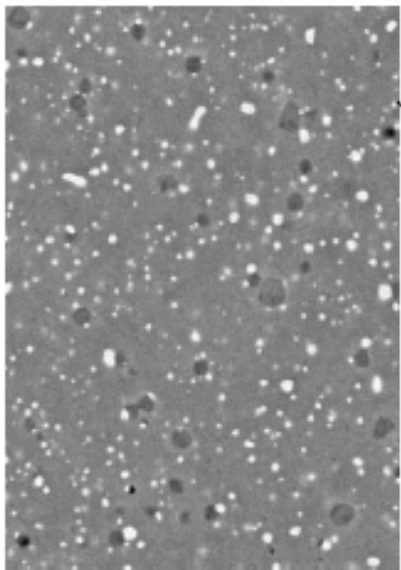
**Tempering temperature:
540 – 570°C**



How to determine Ductility in very hard materials ?

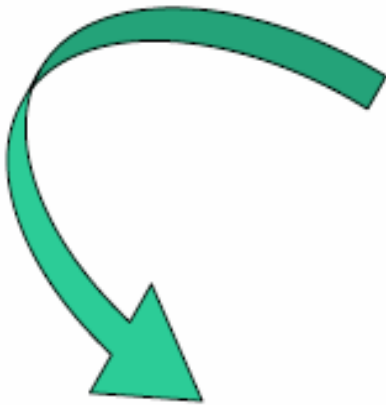
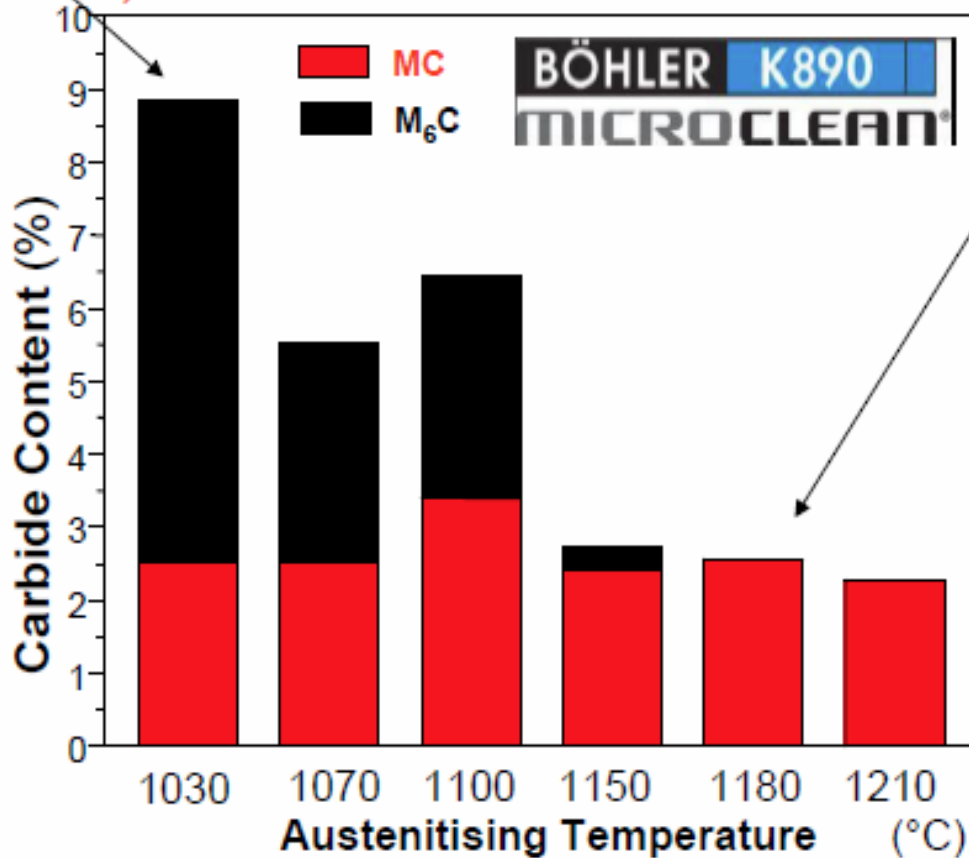
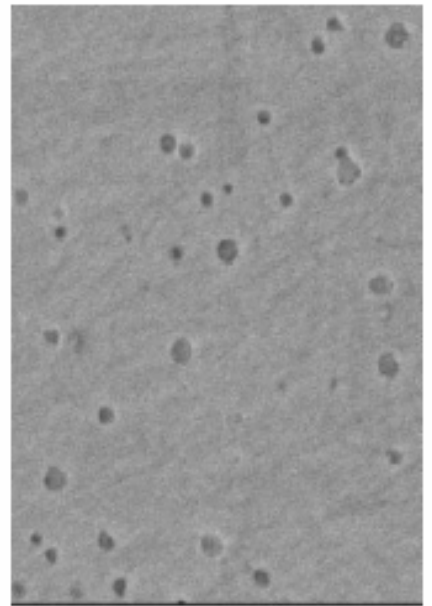
Recommended Heat treatment parameters

台灣 梧濟 / 上海 信昌

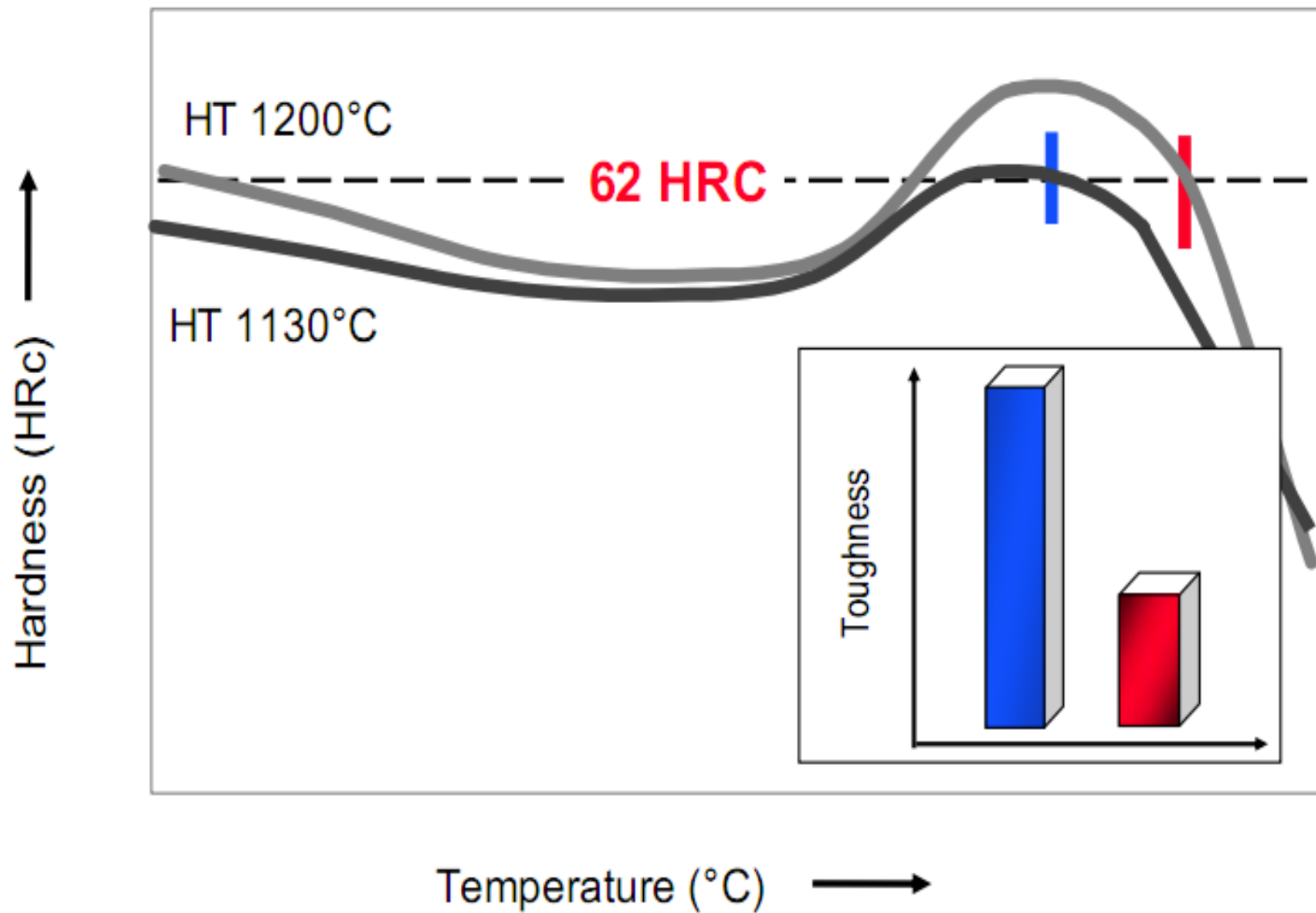


T_A 1030 °C
~6% M_6C
~2,5% MC

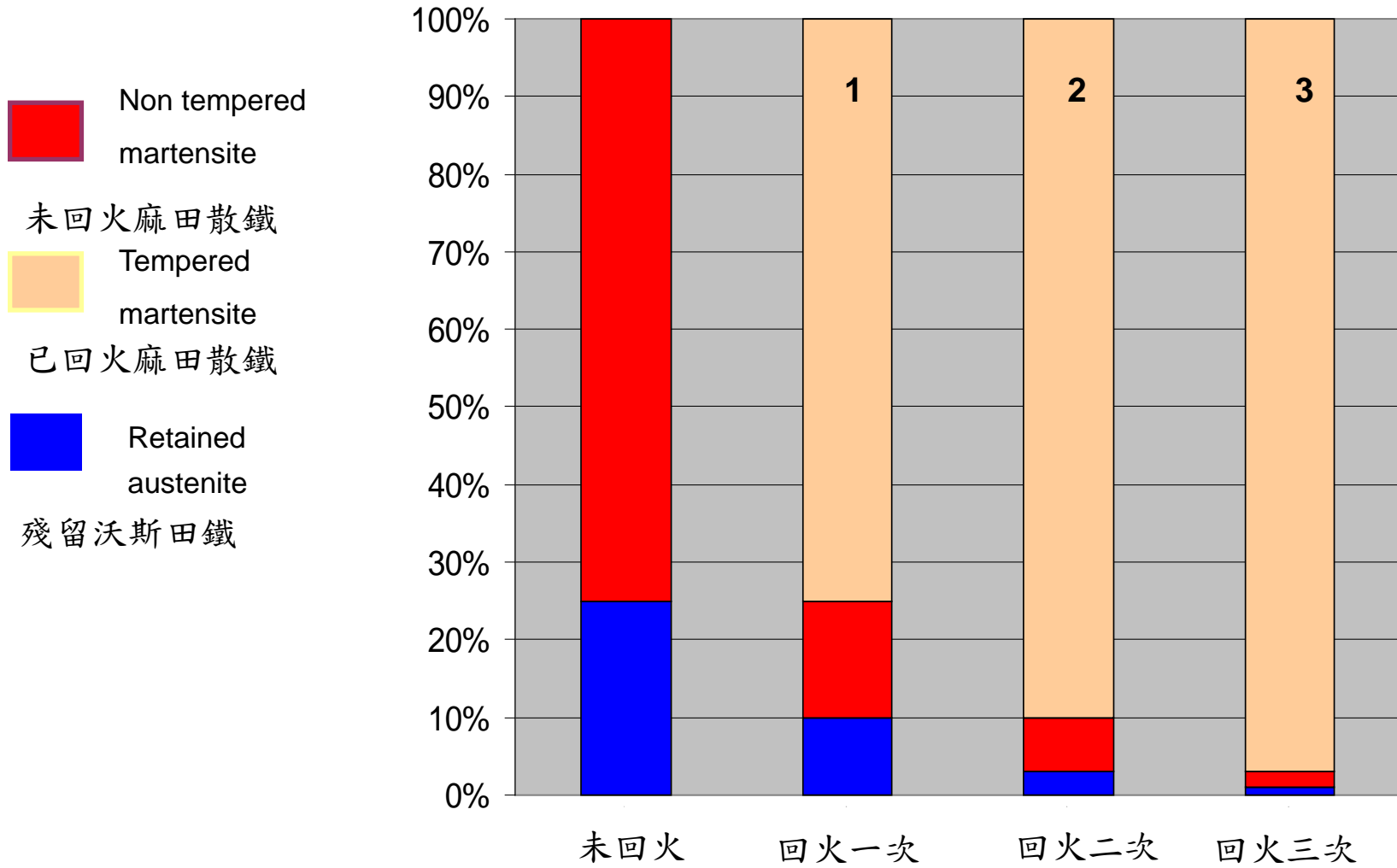
T_A 1180 °C
~ 2,5 % MC



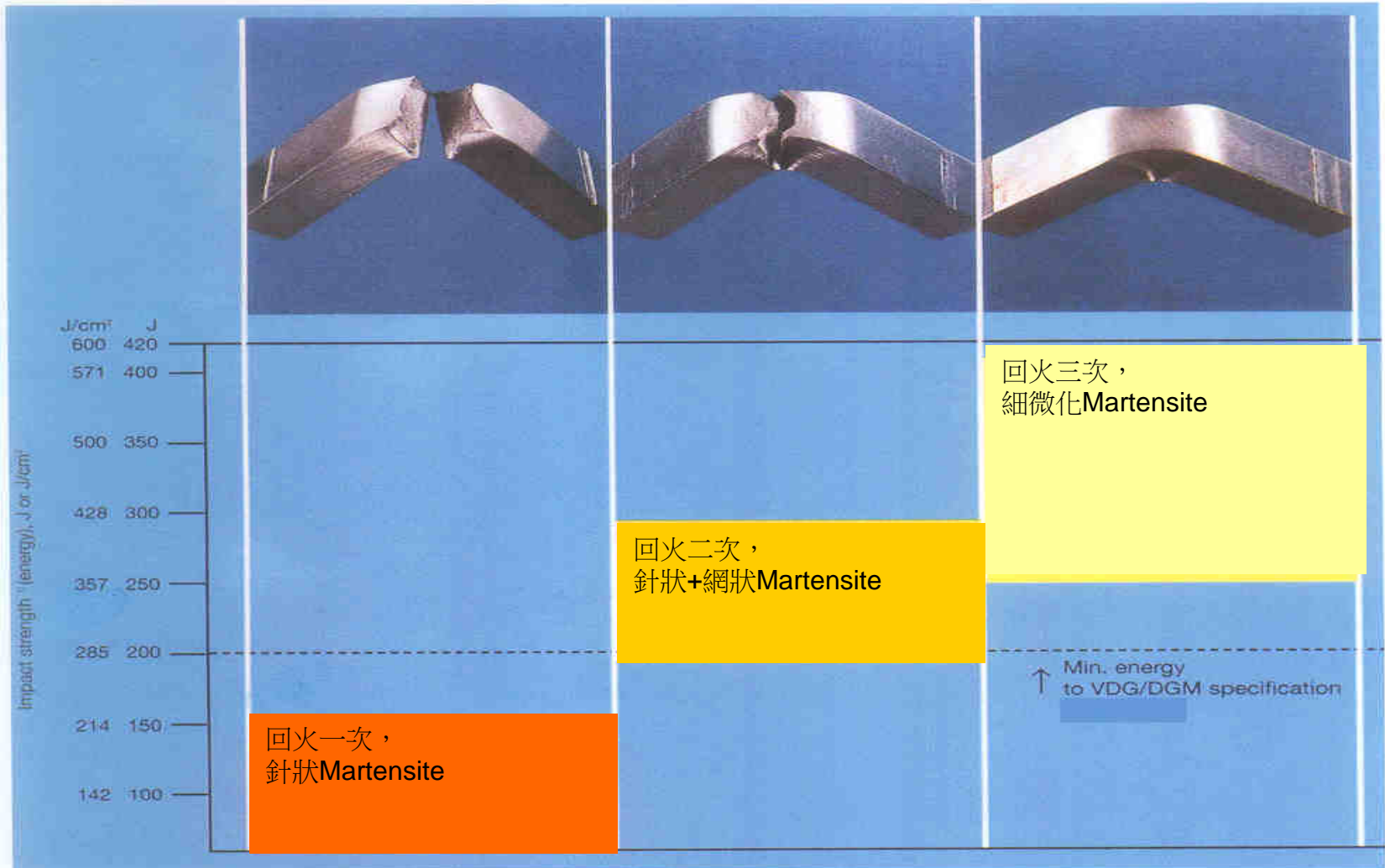
Variable Properties Profile by specifically adjusted Heat Treatment



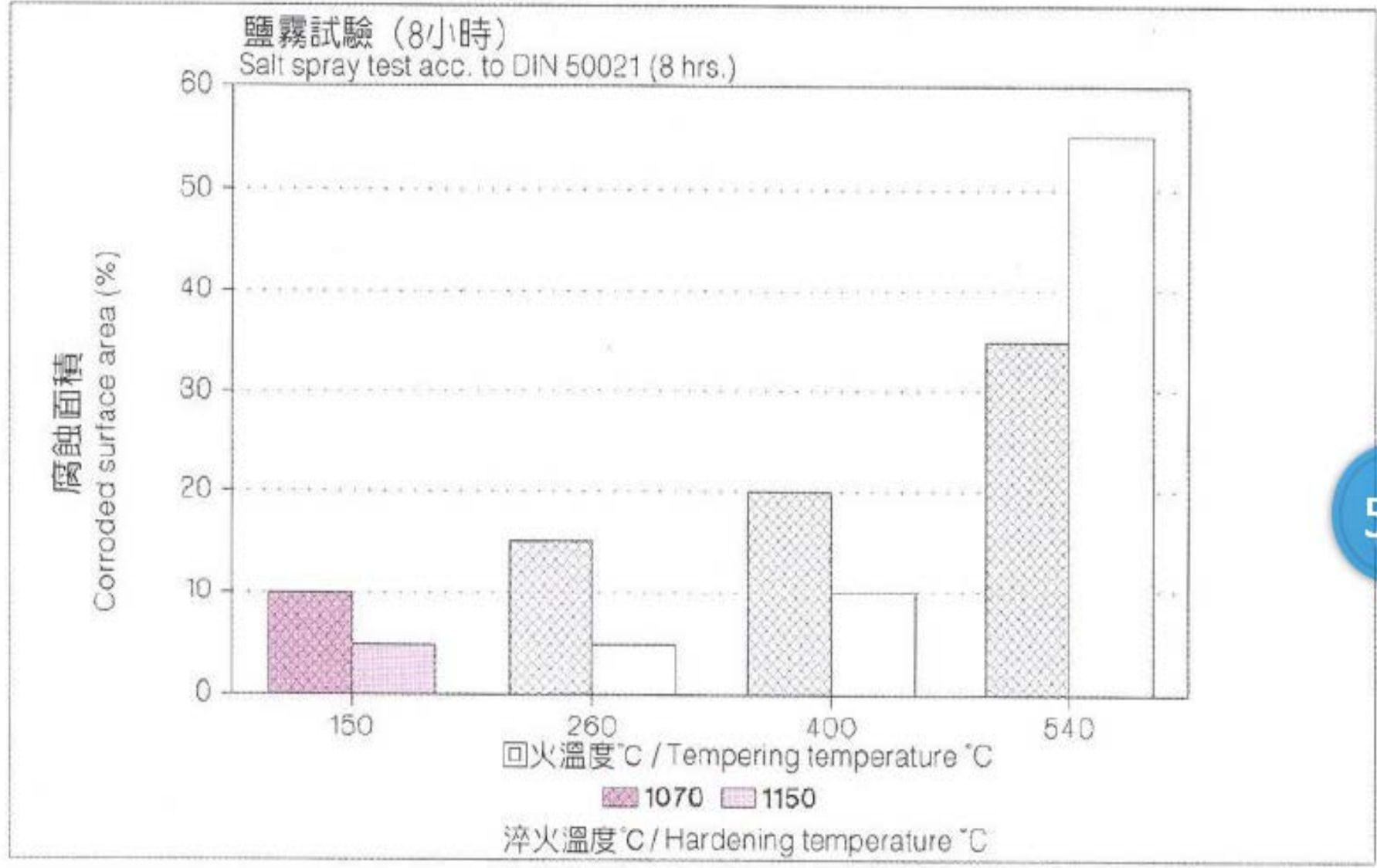
Tempering times (回火次數)



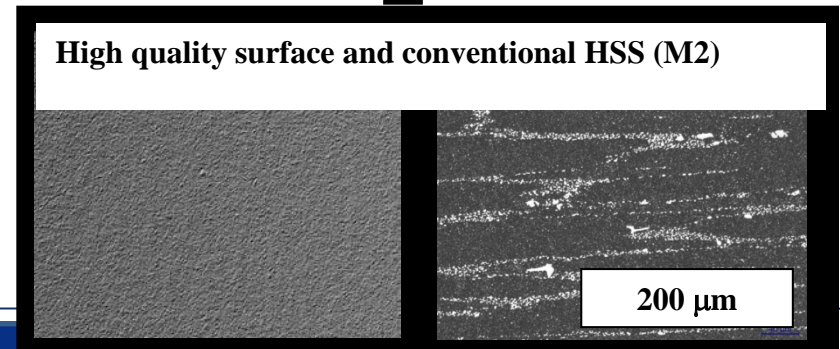
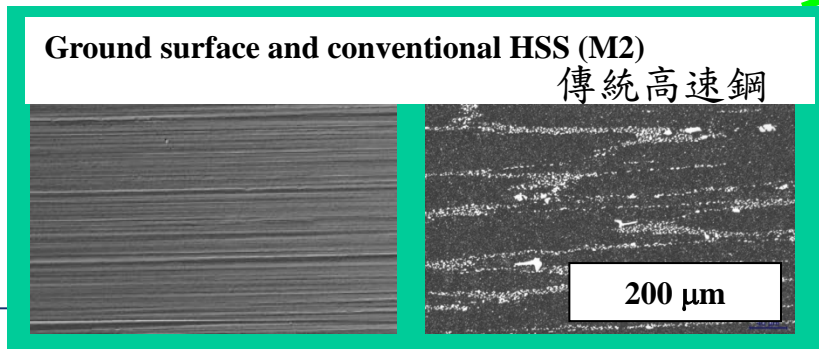
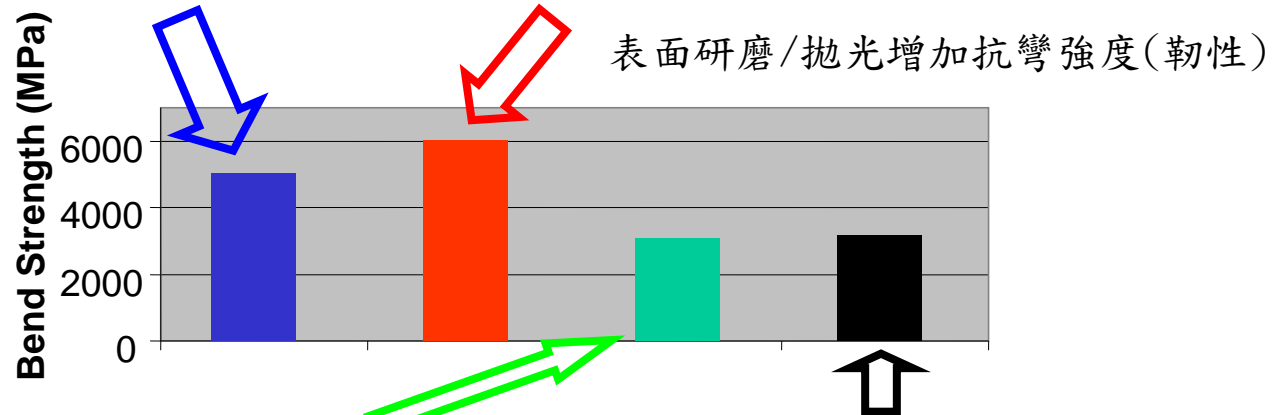
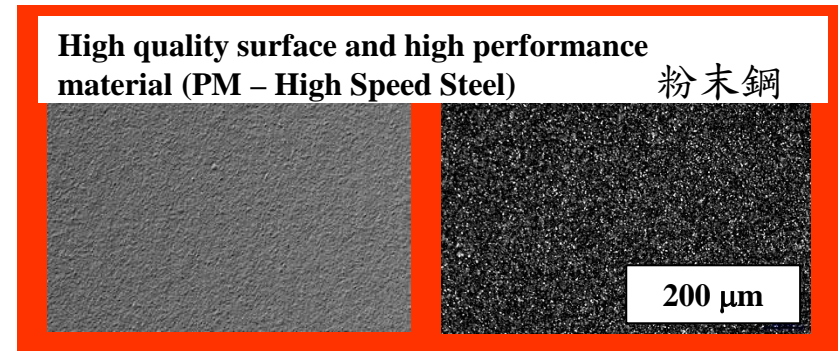
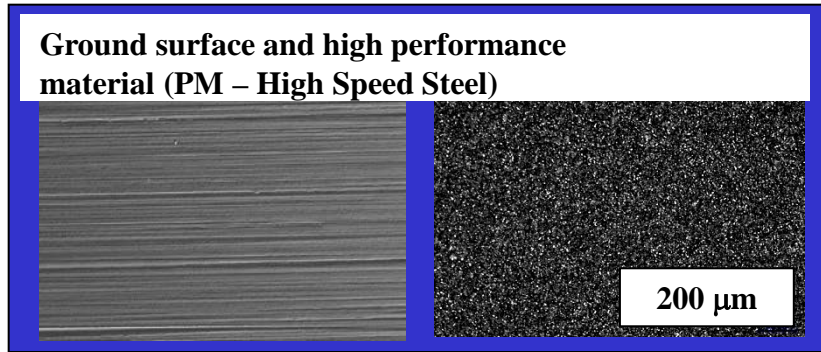
回火時間、次數與不同衝擊強度關係圖



In many cases our special quality = 1.2344 Micro 900/BG (not ESR) is sufficient to produce high quality tools.



表面狀態影響韌性





表面拋光可增加**韌性**、**耐蝕性**



拋光不佳 **韌性差**
容易斷裂

台灣梧濟/上海信昌

Thank you for your attention