



塑料模具钢
PLASTIC MOULD STEEL

BÖHLER M333
ISOPLAST®

成就客户就是成就自己!
服务无止境 德松模具钢



塑料模具钢 / PLASTIC MOULD STEEL

德松模具钢

400-756-1028

www.diesteelchina.com

保证具有镜面光洁度

WITH A MIRRORED FINISH GUARANTEE

对于批量生产的产品，其质量标准和设计要求正在逐步提高。模具制造商正面临着一个挑战，即把产品设计师的想法付诸实践。除了精致而昂贵的光刻结构，高光泽度的表面也是产品设计上不可缺少的环节。产品畅销与否，有时仅凭肉眼或者用敏感的手指轻轻一触便能决定。

高光泽度的表面是否符合所有光学要求，很大程度上取决于模具的特性和质量。工具钢中的杂质必定会反映在产品上。只有使用冶金纯净度高的模具钢，才能加工出高光泽度的表面。

BÖHLER的M333 ISOPLAST塑料模具钢已经问世，它可以让模具制造商以更低的成本和简易的抛光步骤实现高光泽表面。

特殊重熔工艺使之成为可能

通过这项工艺，在充满氮气及/或氩气（无氧气）的密闭容器中进行重熔。这使得氧化物纯度得到提升，进一步增强了钢材的耐腐蚀性、抛光性、光蚀性和电火花加工性。

The quality standards and design requirements for products made in series production are steadily increasing. Toolmakers are being challenged to put the ideas of product designers into practice. Besides elaborately and costly photo-etched structures, a high-gloss surface is an essential feature in product design. It is the naked eye or a sensitive finger tip that decides whether a product will be a fast seller or a shelf-warmer.

Whether a high-gloss surface meets all the optical requirements strongly depends on the tool's features and qualities. Impurities in the tool steel inexorably appear in the final product. High-gloss surfaces can only be achieved with high-purity metallurgical tool steels.

BÖHLER'S M333 ISOPLAST plastic mould steel has been developed to fulfill just this requirement and offers tool makers the uncomplicated manufacture of high-gloss surfaces at low costs.

A special remelting technology makes it possible

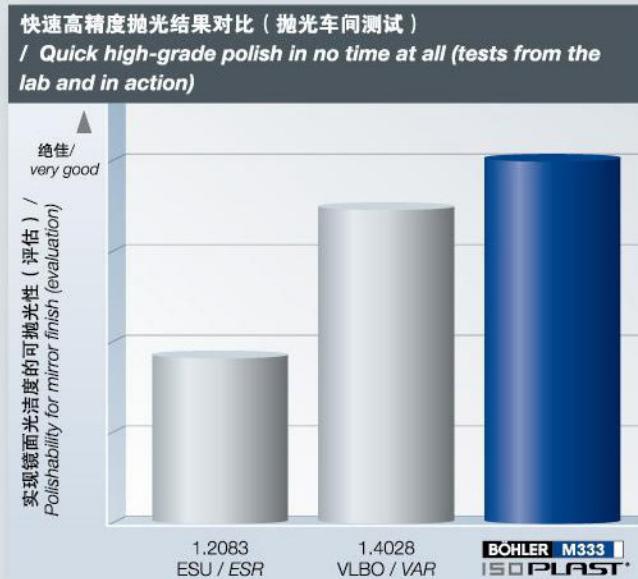
This technology allows for remelting in a closed vessel in a nitrogen and/or argon atmosphere, that is excluding oxygen. Thus an increase in the degree of oxide purity level is achieved and, as a result, improved corrosion resistance, polishability, photo etching and spark eroding of the steel is realized.



优点一览 ADVANTAGES AT A GLANCE

优点

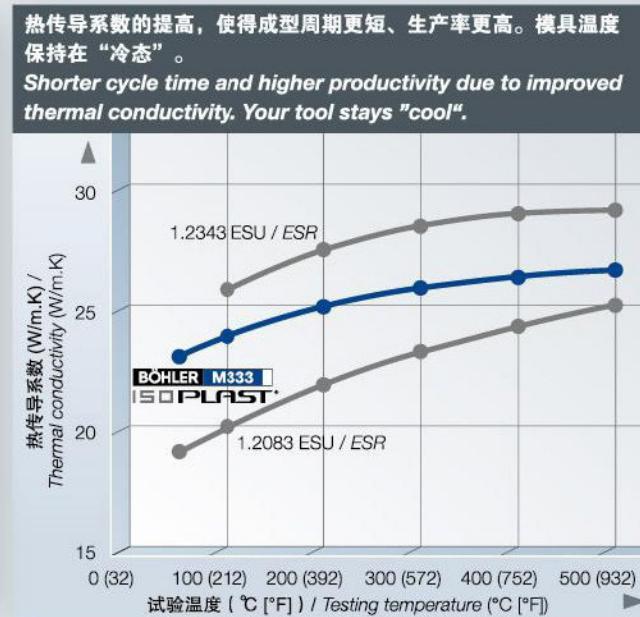
- 最佳的镜面抛光性能
- 更高的热传导率
- 超凡的韧性
- 绝佳的耐蚀性



数家奥地利和德国公司，对每种材料的6个试样进行机器抛光和人工抛光后，得到的关于抛光耗时和抛光质量的研究数据的均值。
/ Mean values of the findings of several Austrian and German companies regarding time and quality after mechanical and handpolishing of 6 samples of each material.

Advantages

- Optimum polishability for mirror finish
- Improved thermal conductivity
- Exceptional toughness
- Very good corrosion resistance



材料中心 / Source: Materials Center Leoben Forschung GmbH, ÖGI



生产效率 PRODUCTIVITY

更高的生产效率，更低的成本

通过与模具专家的通力协作，BÖHLER采用全新的重熔技术，开发出了具有革新化学成分的最新产品，这种材料具有最佳的抛光性能、绝佳的韧性、超凡的耐腐蚀性和更好的热传导性。

这一系列绝佳的性能，极大地减少了为达到镜面光洁度所需的抛光工作、确保了模具有更长的使用寿命（确保减少新模具的需求量、减少维护和维修的时间，并提高防止开裂的安全性）。并通过缩短注塑成型的周期，保证了生产率的提升，从而降低了生产成本。

这对需要生产镜面模具的制造商来说，风险降到了最低，所有这些无疑保证了生产成本的减少。

“保证镜面效果”的配方。

Higher productivity with lower costs

Working with tooling specialists, BÖHLER has developed a material with a revolutionary composition, manufactured via a new melting technology, resulting in the best polishability, outstanding toughness, very good corrosion resistance and improved thermal conductivity.

This collection of positive attributes guarantees cost savings by considerably reducing the effort needed for polishing to a mirror finish, guaranteeing longer mould life, (thus ensuring reduced need for new tools, reducing maintenance and repair time, and providing security against fracture) and increasing productivity by shortening cycle times.

Thus, the production of mirrored finish moulds means no more risk for the mould maker.

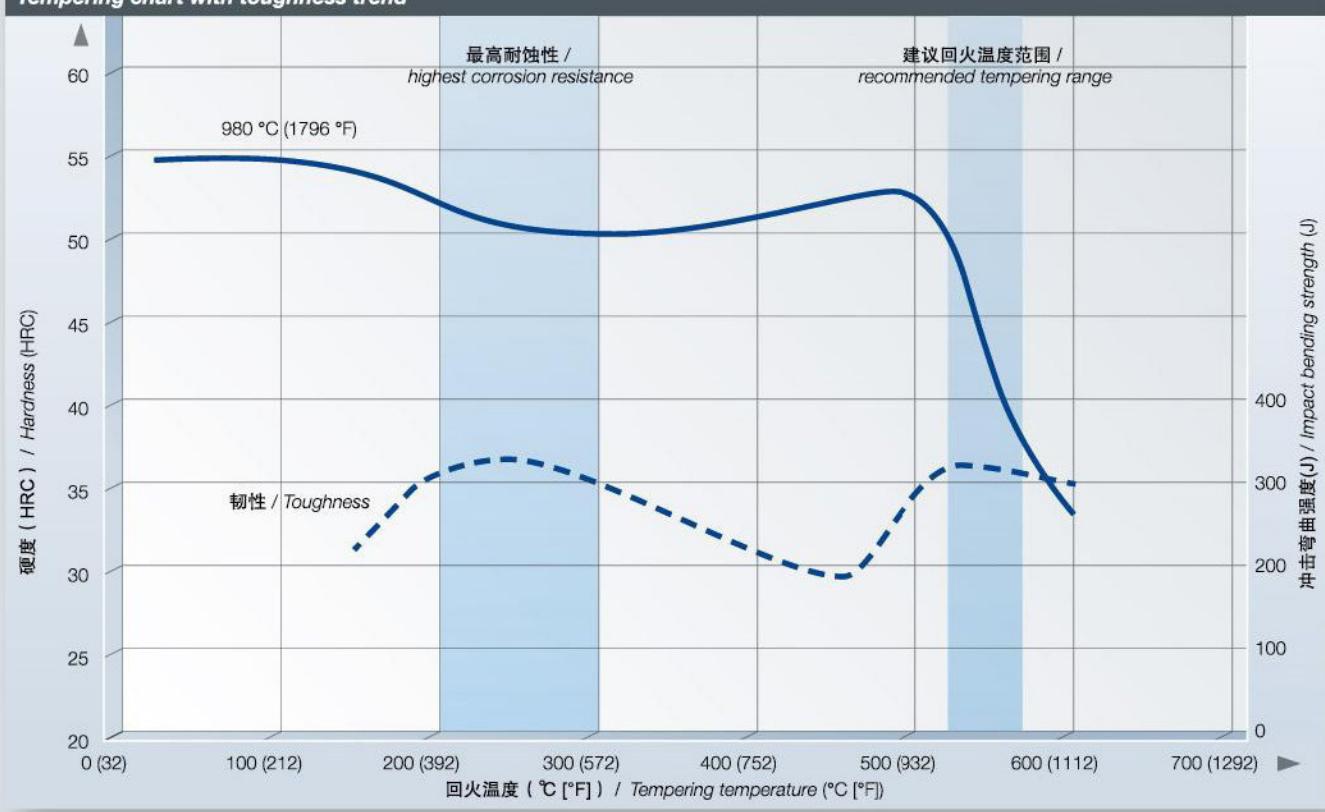
The recipe with a "mirrored finish guarantee".

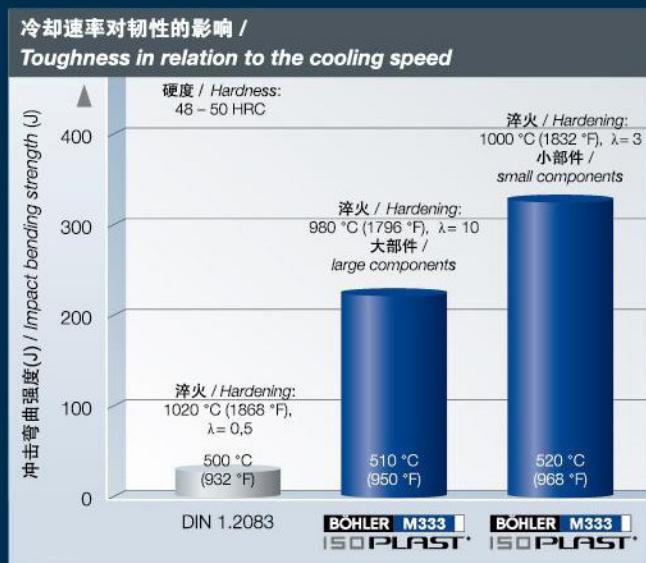
化学成分 (平均值%) / Chemical composition (average %)				
C	Si	Mn	Cr	其他 / others
0,24	0,20	0,35	13,25	+N, Mo, V, Ni



非凡性能 EXTRAORDINARY PROPERTIES

韧性趋势的回火图 /
Tempering chart with toughness trend



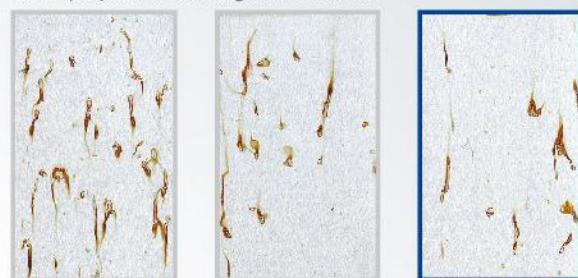


回火 / Tempering 2 x 120 min.
冷却参数 λ = 从800 到 500 °C (1470 – 930 °F) 的冷却时间，
单位: 秒 $\times 10^{-2}$ /
Cooling parameter λ = duration of cooling from 800 to 500 °C
(1470 – 930 °F) in seconds $\times 10^{-2}$
无缺口冲击试样 (10 x 7 x 55 mm) 取自模具心部 /
Impact-samples, unnotched (10 x 7 x 55 mm) from centre of tool

更高的耐腐蚀性能减少了模具的维护工作。盐雾腐蚀的测试结果不会说谎。

/ Less maintenance work due to improved corrosion resistance. Chemistry proves it – saltwater cannot be bribed.

根据DIN 50021进行的盐雾试验 /
Salt spray test according to DIN 50021



试样热处理: 1000 °C (1832 °F) /油冷+ 250 °C (482 °F) / 2 x 2小时。
Specimen heat treatment: 1000 °C (1832 °F) / oil-cooling + 250 °C
(482 °F) / 2 x 2 hrs.

热处理 HEAT TREATMENT

正确的热处理可保证最佳性能

交货状态

- 退火后硬度：最高220 HB

应力消除

- 约650 °C (1202 °F)
- 工件热透后，在中性气氛中保温1–2小时
- 随炉慢冷

淬火

- 980到1000 °C(1796 – 1832 °F)，快速冷却， $\lambda < 10$
- 大模具的淬火温度强烈推荐为980 °C (1796 °F)
(有效厚度 > 80 mm, 真空氮气冷却)。
- 工件热透后的保温时间：15 – 30 分钟。

回火

- 淬火后应直接回火。
- 建议回火3次。
- 保温时间以材料厚度计算，每20mm保温1小时，最少2小时。

Right heat treatment means optimum results

Delivery condition

- soft annealed max. 220 HB

Stress relieving

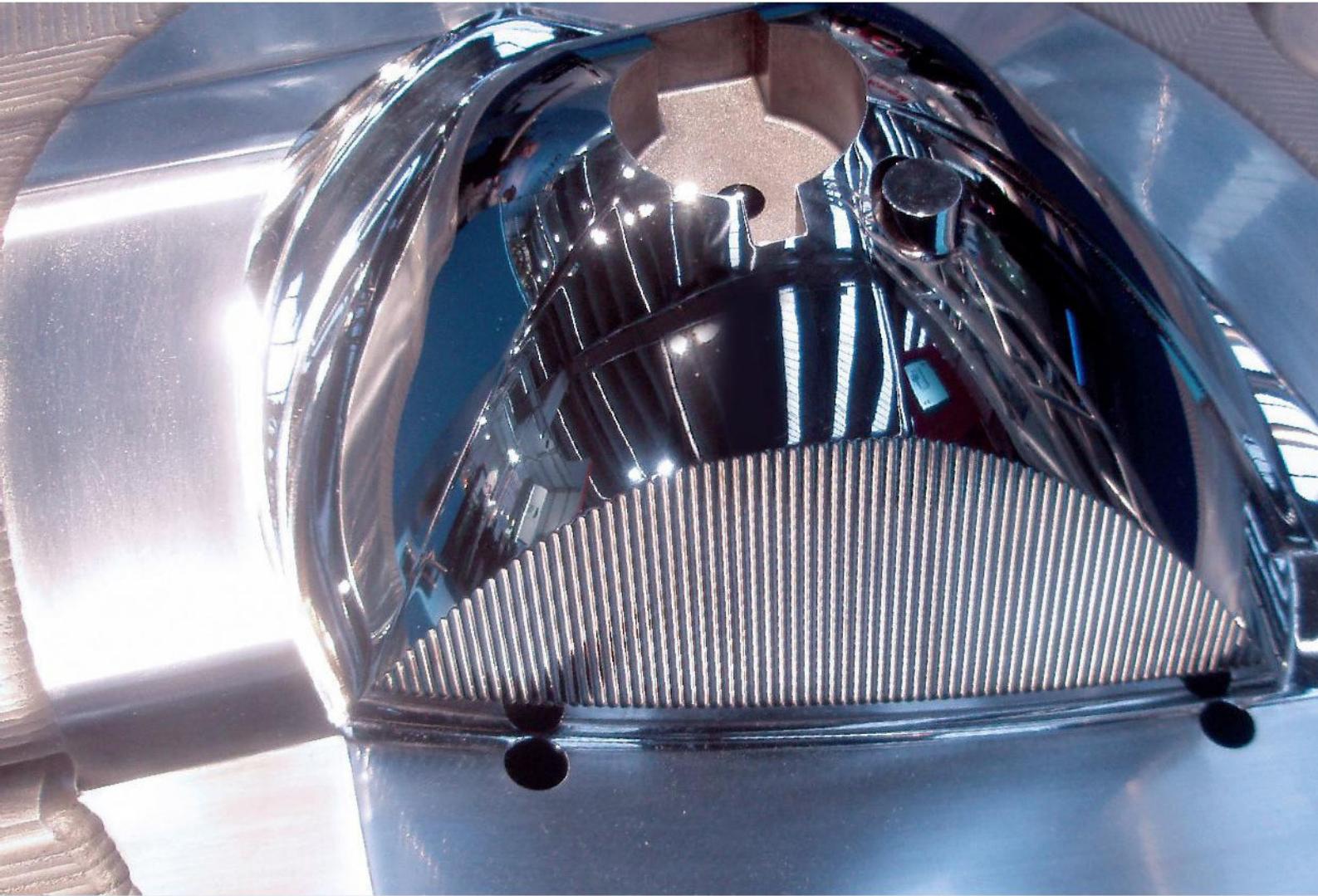
- approx. 650 °C (1202 °F)
- following temperature equalisation, hold at temperature for 1 – 2 hours in a neutral atmosphere
- slow furnace cooling

Hardening

- 980 to 1000 °C (1796 – 1832 °F), quick quenching as possible, $\lambda < 10$
- 980 °C (1796 °F) are strongly recommended for large moulds (relevant thickness > 80 mm and vacuum N₂-cooling).
- Holding time: 15 – 30 minutes after temperature equalisation.

Tempering

- Tempering should be done directly following hardening.
- Tempering 3 times is recommended.
- Holding time in the furnace 1 hour per 20 mm material thickness, at least 2 hours in any case.



最高目标硬度

- 48 – 50 HRC

大尺寸模具的热处理

可通过高温回火 ($> 510^{\circ}\text{C} / 950^{\circ}\text{F}$) 使内应力处于最佳状态。这对热处理后，需要进行电火花加工或表面处理的模具尤为重要。

Maximal goal hardness

- 48 – 50 HRC

Heat treatment of big moulds

The best condition of internal stress can be obtained by tempering at high temperatures ($> 510^{\circ}\text{C} / 950^{\circ}\text{F}$). This is particularly important when spark erosion or surface treatment is carried out after heat treatment.

热处理 HEAT TREATMENT

CCT曲线图 / Continuous cooling CCT curves

奥氏体化温度: 1000 °C (1832 °F)
保温时间: 15分钟

2 ... 100 相百分比 %

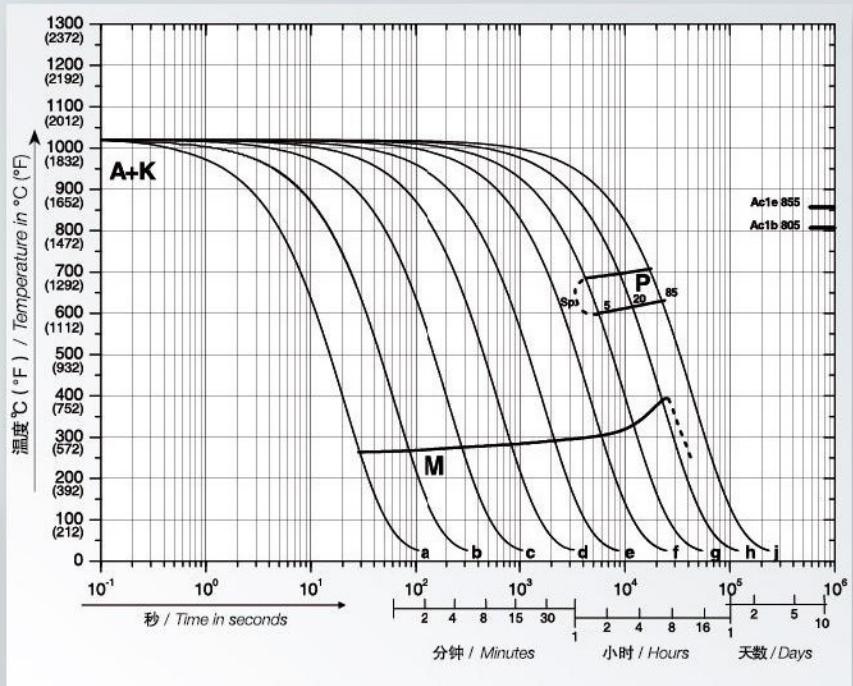
0,1 ... 220 冷却参数 (λ) ,
即从800到500 °C的冷却时间,
单位: 秒 $\times 10^{-2}$

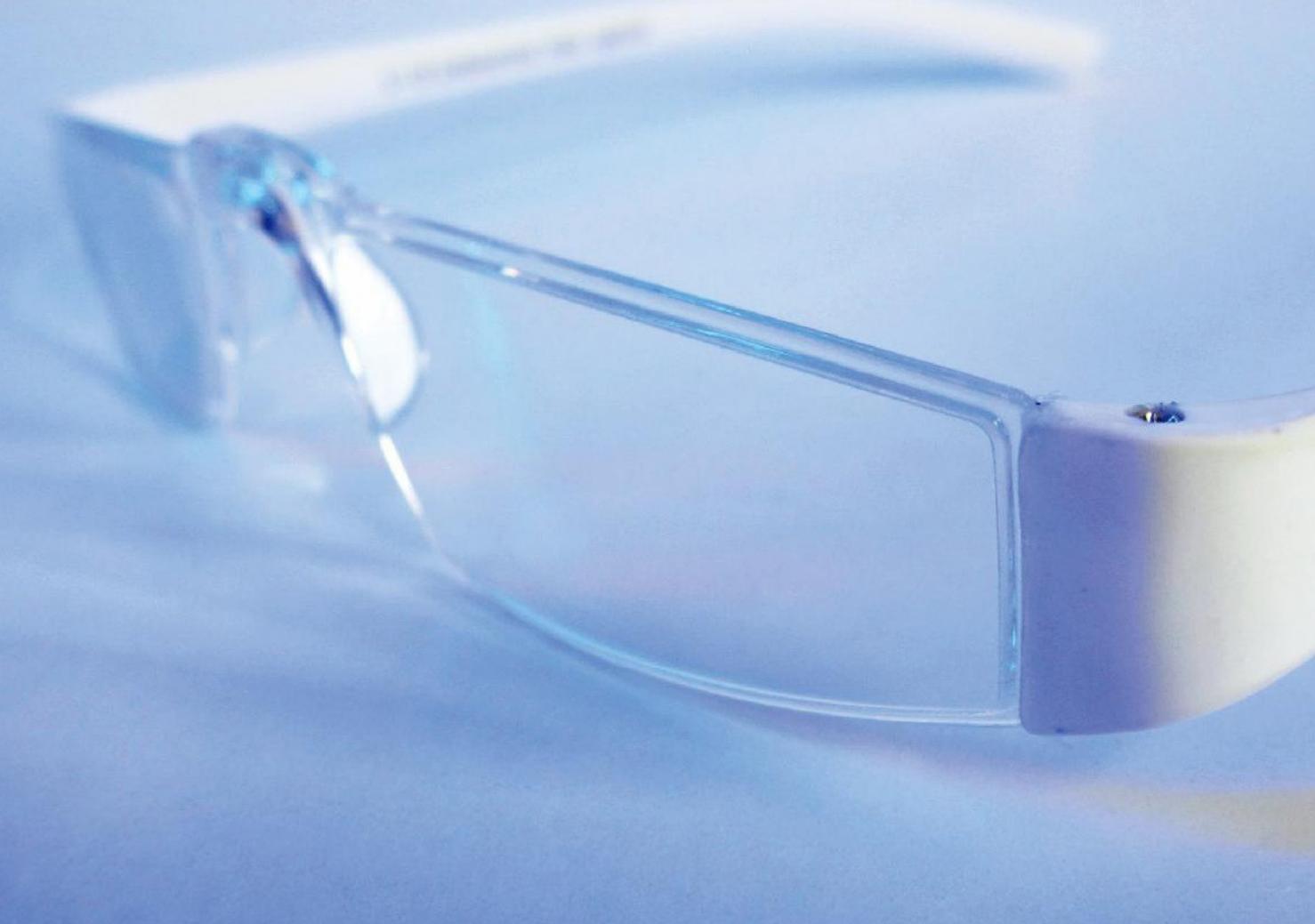
Austenitizing temperature: 1000 °C (1832 °F)
Holding time: 15 minutes

2 ... 100 phase percentages

0,1 ... 220 cooling parameter (λ), i.e. duration of
cooling from 800 – 500 °C
(1470 – 930 °F) in s $\times 10^{-2}$

Probe / Sample	λ	HV ₁₀	RA
a	0,10	580	1,50
b	0,30	580	1,50
c	1,00	580	1,50
d	3,00	580	2,00
e	8,00	580	3,00
f	23,00	570	4,00
g	50,00	525	3,00
h	110,00	360	2,00
f	220,00	215	< 1,00





定量相图 / Quantitative phase diagram

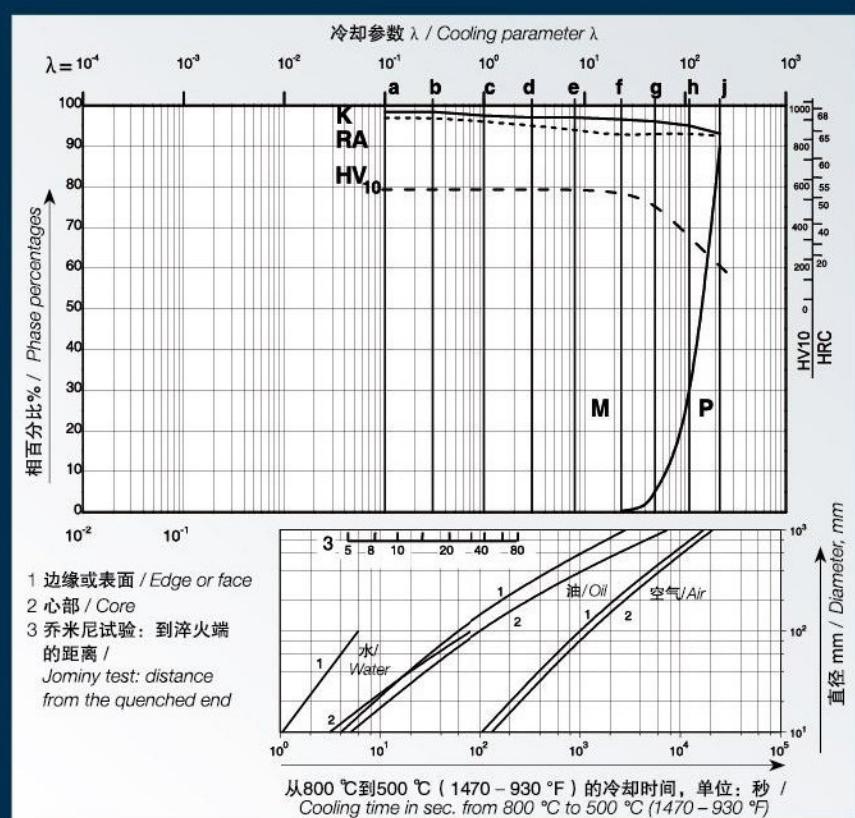
K 碳化物 /Carbide

RA 残余奥氏体 /Retained austenite

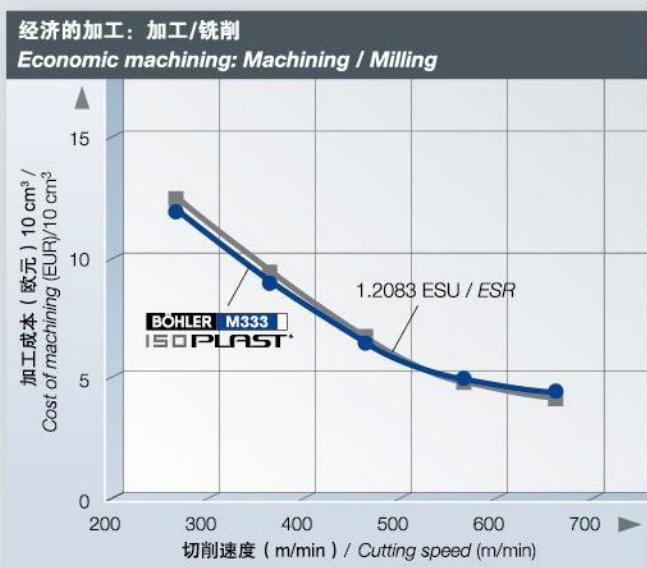
A 奥氏体 /Austenite

M 马氏体 /Martensite

P 珠光体 /Perlite

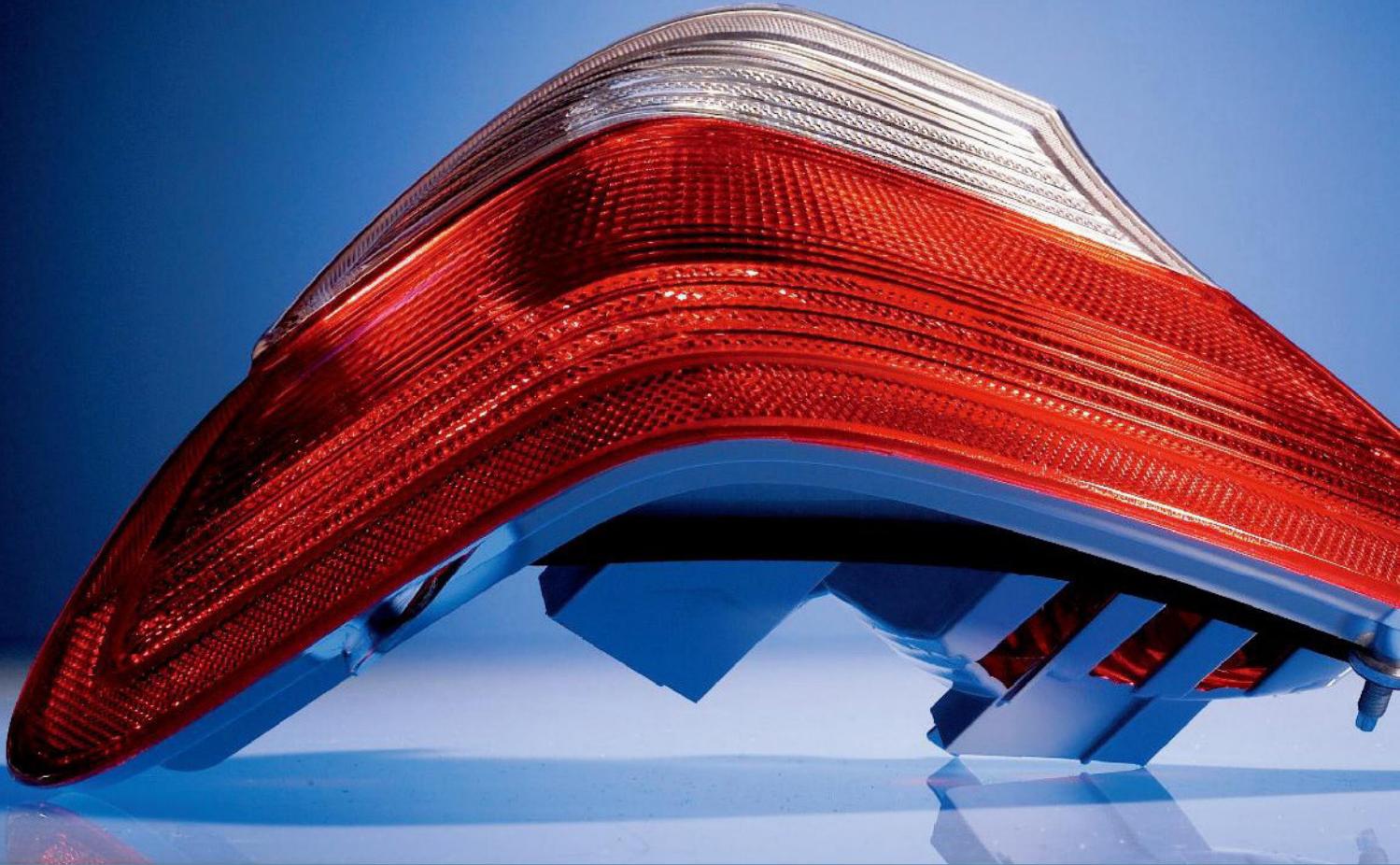


机加工建议 RECOMMENDED MACHINING PARAMETERS



软性退火状态下，铣削成本和刀具寿命如左图所示，选用镶嵌硬质合金刀具进行试验，寿命以刀片磨损带宽度达到0.35mm为准。

The costs and tool life for milling the steels in the soft annealed condition were determined with hard metal indexable insert tools and refer to a wear band width of 0.35 µm.



加工技术对抛光时间的影响 / *Influence of the machining technique on the time required in polishing*

材料: BÖHLER M333 ISOPLAST
淬火和回火至50 HRC左右 /
*Material: BÖHLER M333 ISOPLAST
hardened and tempered to approx. 50 HRC*



用硬质合金刀具铣削后的表面抛光
Surface finish following milling with carbide tool

与电火花加工的表面相比，在铣削后型腔表面进行抛光以达到规定镜面光洁度的时间节省约20%。

电火花加工 / *Electrical discharge machining*

纯净度有助于产生良好的放电加工性能 /
As a result of the cleanliness level good EDM-properties



用铜电极进行电火花加工后的表面
Surface finish following spark eroding with a copper electrode

Approx. 20 % less time is required to reach a defined mirror-finish on a cavity which has been milled compared to a spark eroded surface.

机加工建议 MACHINING RECOMMENDATIONS

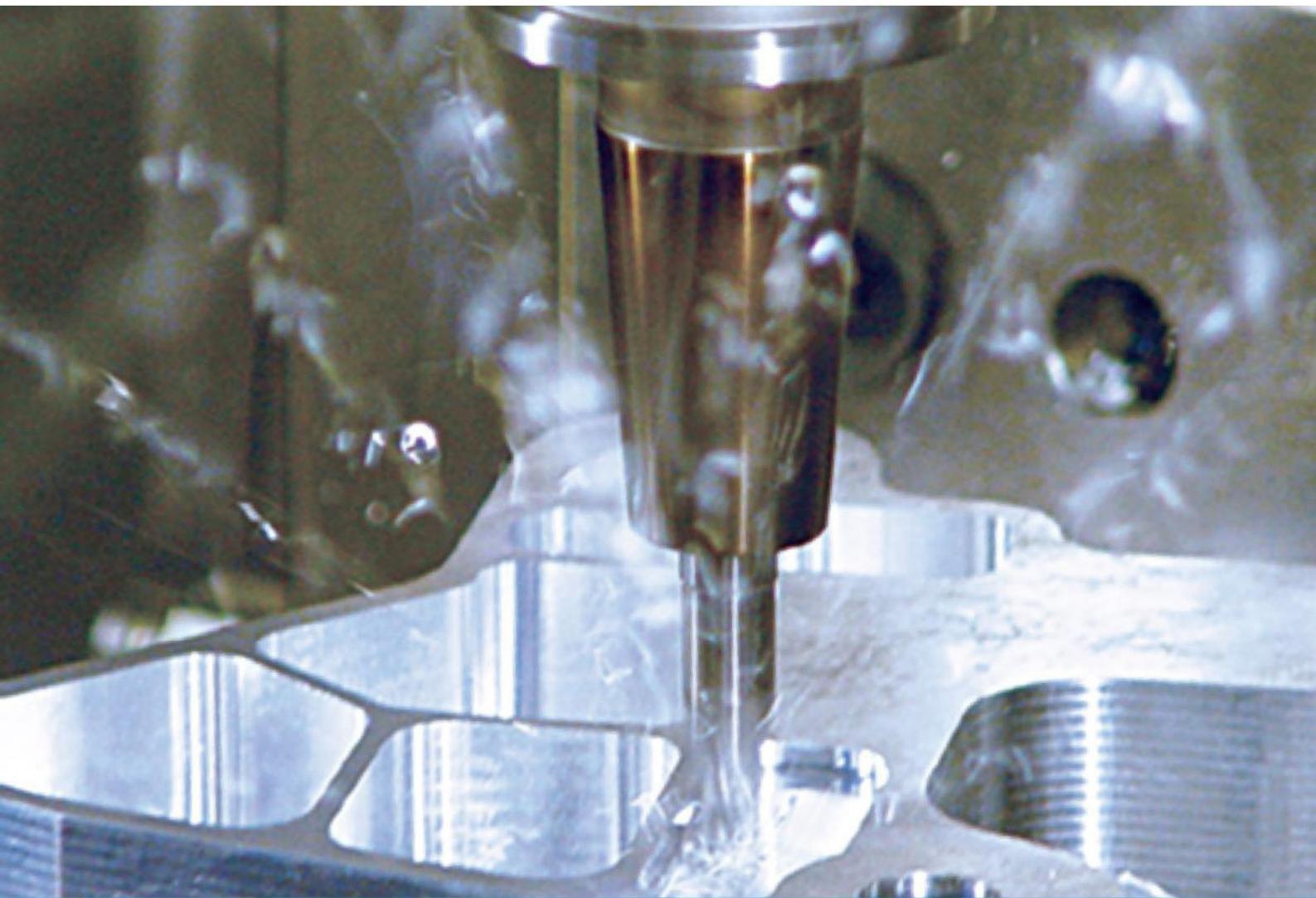
热处理状态: 软性退火/铣加工表面 / Heat treatment condition: soft annealed / mill finish

车削 / Turning			
车削深度 mm (英寸) / Depth of cut mm (inches)	8 – 4 (.31 – .16)	4 – 1 (.16 – .04)	1 – 0,5 (.04 – .02)
进给量 mm / rev. (inches / rev.) / Feed mm / rev. (inches / rev.)	0,8 – 0,4 (.032 – .016)	0,4 – 0,25 (.016 – .01)	0,25 – 0,1 (.01 – .004)
切削速度 v_c m/min (f.p.m) / Cutting speed v_c m/min (f.p.m)			
BOEHLERIT LC 225 C / ISO HC-P25	110 – 150 (360 – 490)	150 – 200 (490 – 660)	190 – 300 (625 – 985)
BOEHLERIT LC 235 / ISO HC-P53	90 – 130 (295 – 425)	130 – 180 (425 – 590)	170 – 280 (395 – 920)

铣削 / Milling			
进给量 mm/tooth (inches/tooth) / Feed mm/tooth (inches/tooth)	0,5 – 0,36 (.02 – .014)	0,35 – 0,16 (.014 – .006)	0,15 – 0,08 (.006 – .003)
切削速度 v_c m/min (f.p.m) / Cutting speed v_c m/min (f.p.m)			
BOEHLERIT LW 225 / ISO HW-P25	60 – 100 (195 – 330)	70 – 110 (230 – 360)	80 – 120 (260 – 395)
BOEHLERIT LC 225 M / ISO HC-P25	80 – 120 (260 – 395)	100 – 150 (330 – 490)	140 – 190 (460 – 625)
BOEHLERIT LC 230 F / ISO HC-P30	70 – 100 (230 – 330)	80 – 130 (260 – 425)	120 – 170 (395 – 560)

表中加工参数适用于无冷却液并采用镶嵌硬质合金刀具。
如果使用整体硬质合金刀具，应采用较小的进给量。

Cutting material recommendations for dry machining, standard values for indexable insert tools. If using carbide tooling a lower feed should be used.



钻孔 / Drilling

钻头直径 mm (inch) / Drill diameter mm (inches)	3 – 20 (.12 – .80)	20 – 54 (.80 – 2.13)	
硬质合金刀具 / Carbide tooling	可换式刀具 / Indexable inserts		
进给量mm / rev. (inches / rev.) / Feed mm / rev. (inches / rev.)	0,15 – 0,25 (.006 – .01)	0,05 – 0,20 (.002 – .008)	
切削速度vc m/min (f.p.m) / Cutting speed vc m/min (f.p.m)			
Fette LC 640S/ISO HC-K40	50 – 100 (165 – 330)	50 – 100 (165 – 330)	
BOEHLERIT R 331 / ISO HC-P30	150 – 200 (490 – 660)	150 – 200 (490 – 660)	
BOEHLERIT SB 40 / ISO HW-P40	100 – 140 (330 – 460)	100 – 140 (330 – 460)	

补焊

模具钢在焊接后通常有产生裂纹的倾向或风险。如果焊接无法避免，应获取并遵循相应焊条制造商的说明，或查看BÖHLER的焊接手册。

Repair welding

There is a general tendency for tool steels to develop cracks after welding.

If welding cannot be avoided, the instructions of the appropriate welding electrode manufacturer should be sought and followed or check in the BÖHLER welding leaflet.

任何尺寸和形状下都有卓越表现

SHINES IN EVERY DIMENSION AND SHAPE

物理性能 / Physical properties

密度 (20 °C) / Density at 20 °C Density at 68 °F	7,7 kg/dm ³ 0.278 lbs/in ³
比热 20 (°C) / Specific heat capacity at 20 °C Specific heat capacity at 68 °F	460 J/(kg.K) 0.110 Btu/(lb °F)
磁性：有磁 / Magnetic properties existing	

材料中心 / Source : Materials Center Leoben Forschung GmbH, ÖGI

热传导率 / Thermal conductivity

20 °C	100 °C	200 °C	300 °C	400 °C	500 °C	
22,9	23,9	25,1	25,8	26,4	27,0	W/(m K)
68 °F	210 °F	390 °F	570 °F	750 °F	930 °F	
13.23	13.81	14.50	14.90	15.25	15.60	Btu/(ft h °F)



德松模具钢
400-756-1028
www.diesteelchina.com

20 °C 至 ... °C (68 °F 至 ... °F) 时的热膨胀系数 / Thermal expansion between 20 °C (68 °F) and ... °C (°F)

100 °C	200 °C	300 °C	400 °C	500 °C	
10,50	11,00	11,00	11,50	12,00	$10^{-6} \text{ m}/(\text{m.K})$
210 °F	390 °F	570 °F	750 °F	930 °F	
5.83	6.11	6.11	6.39	6.67	$10^{-6} \text{ in}/(\text{in } °\text{F})$

弹性模量 / Modulus of elasticity

20 °C	100 °C	200 °C	300 °C	400 °C	500 °C	
216	212	205	198	190	180	10^3 N/mm^2
68 °F	210 °F	390 °F	570 °F	750 °F	930 °F	
31.3	30.7	29.7	28.7	27.6	26.1	10^3 KSI

材料中心 / Source : Materials Center Leoben Forschung GmbH, ÖGI

您的伙伴:

Your partner:

DESON Die Steel Company Limited

德松模具钢材（东莞）有限公司

德松模具钢材（深圳）有限公司



www.diesteelchina.com

QQ: 3347894946

微信公众号: diesteeel

24小时服务热线: 400-756-1028

邮箱: sales@diesteelchina.com

此型录中的资料仅供参考，除非双方经过合同签订追认法律效力。测量数据是实验室测得值，可能与实际分析存在偏差。
我们的钢材不含伤害健康与环境的有害物质。

The data contained in this brochure is merely for general information and therefore shall not be binding on the company. We may be bound only through a contract explicitly stipulating such data as binding. The manufacture of our products does not involve the use of substances detrimental to health or to the ozone layer.