



TOOL MATERIAL

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河冶科技股份有限公司
HEYE SPECIAL STEEL CO.,LTD.

A WORLD LEADING TOOL AND DIE MATERIAL SUPPLIER AND SOLUTION PROVIDER.

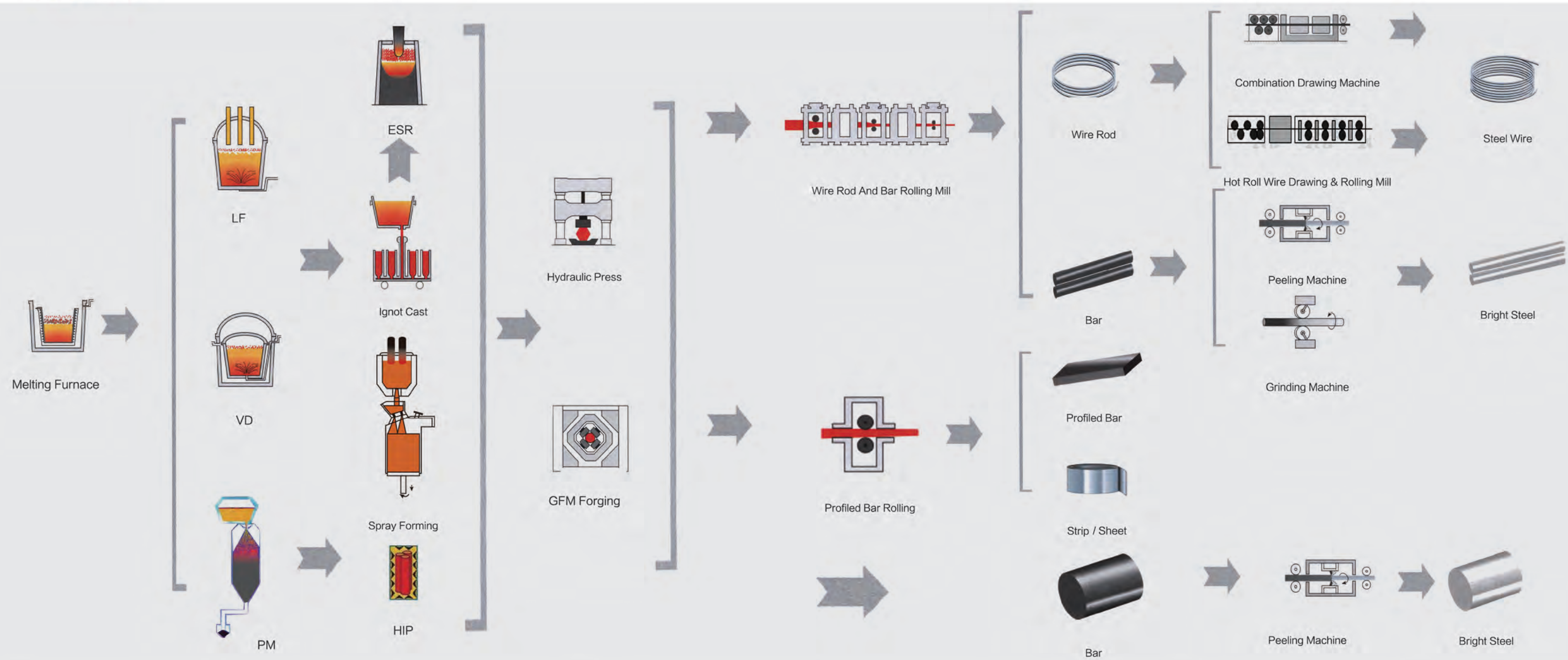
2023 Edition



Material Series

Category		Grade	Similar Grade				Chemical Composition (Wt.%)						Properties Comparison			
			GB	ASTM	JIS	DIN	C	Cr	W	Mo	V	Co	Wear Resistance	Red Hardness	Toughness	Grindability
HSS	W-Mo	HYM2	W6Mo5Cr4V2	M2	SKH51	1.3343	0.8	4	6	5	2	-				
		HYTM2	W6Mo5Cr4V2				0.9	4	6	5	2	-				
		HYW9	W9Mo3Cr4V				0.8	4	9	3	1	-				
		HYM32					Undisclosed									
	Mo	HYM7	W2Mo9Cr4V2	M7	SKH58	1.3348	1.0	4	2	9	2	-				
	W	HYW18	W18Cr4V	T1	SKH2	1.3355	0.8	4	18	-	1	-				
HSS-E	≥4.5% Co	HYM42	W2Mo9Cr4VCo8	M42	SKH59	1.3247	1.1	4	2	9	1	8				
		HYM35	W6Mo5Cr4V2Co5	M35	SKH55	1.3243	0.9	4	6	5	2	5				
		HYT42	W10Mo4Cr4V3Co10		SKH57	1.3207	1.2	4	10	4	3	10				
		HYT15	W12Cr4V5Co5	T15	SKH10	1.3202	1.6	4	12	≤1.0	5	5				
	Al	HYM2Al	W6Mo5Cr4V2Al				1.1	4	6	5	2	Al 1				
	>2.5% V	HYM3	W6Mo5Cr4V3	M3 Cl2	SKH52		1.2	4	6	5	3	-				
		HYTV3					1.2	4	5	6	3	-				
		HYM4	W6Mo5Cr4V4	M4			1.3	4	6	5	4	-				
HSS-L		HYW3V2	W3Mo3Cr4V2				1.0	4	3	3	2	-				
		HYW3					0.85	4	3	2	2	-				
		HYW4	W4Mo3Cr4VSi				0.9	4	4	3	1	-				
		HYM50		M50			0.8	4	≤1.0	4	1	-				
HSS-PM		As shown in the Powder Metallurgy Material brochure														
HSS-SF		As shown in the Spray Forming Material brochure														

Process



VD



ESR



Hydraulic Press



GFM forging



Wire Rod And Bar Rolling Mill



Coil weight of wire rod

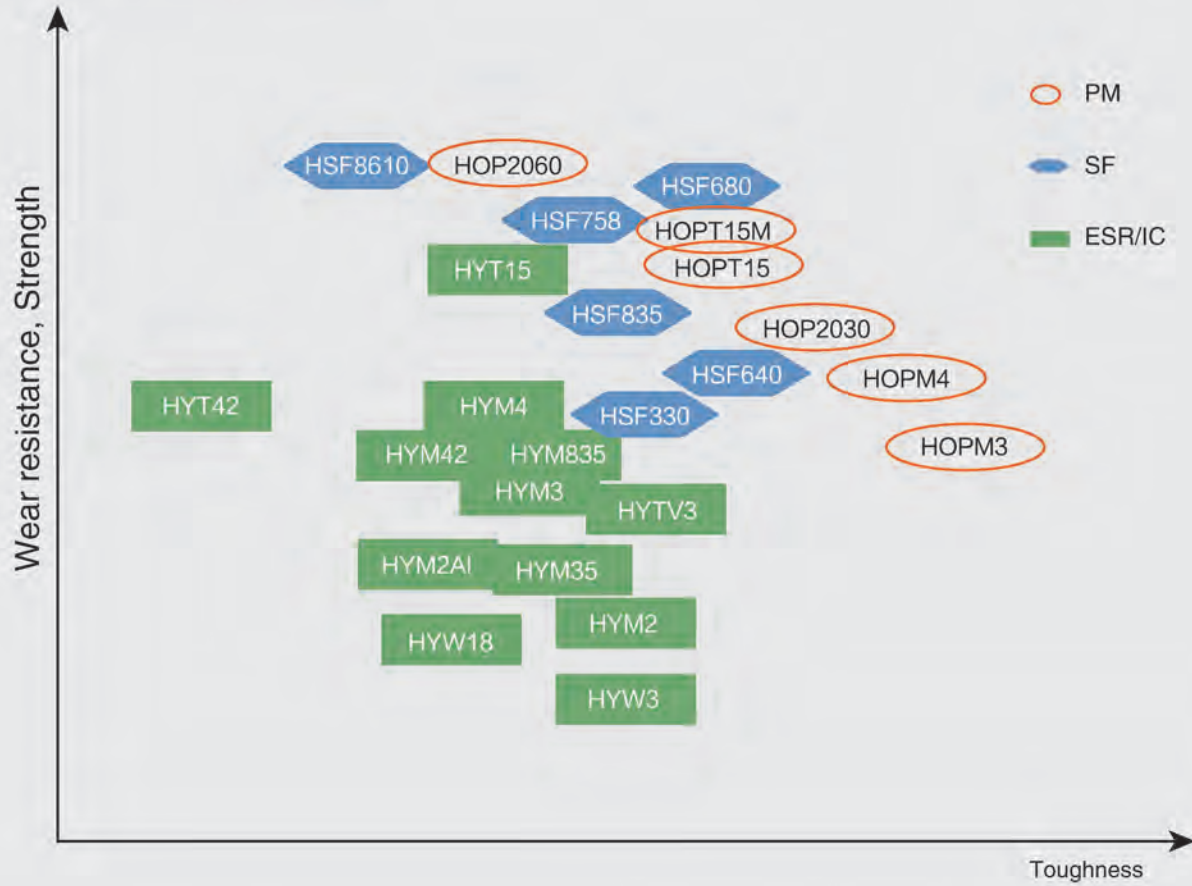


Peeling Machine CPM-075

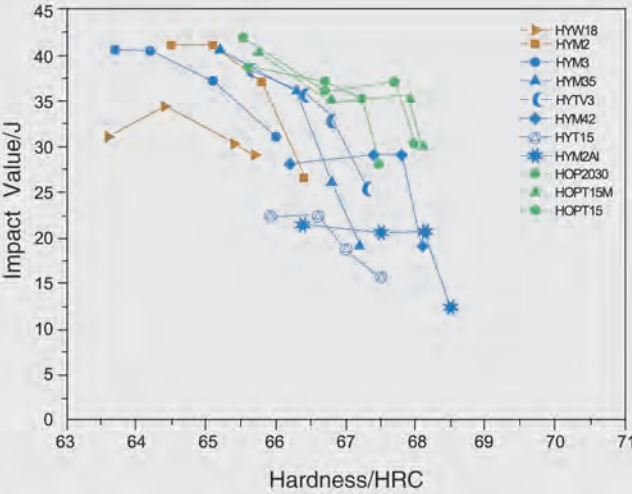


Peeling Machine BPC-5000

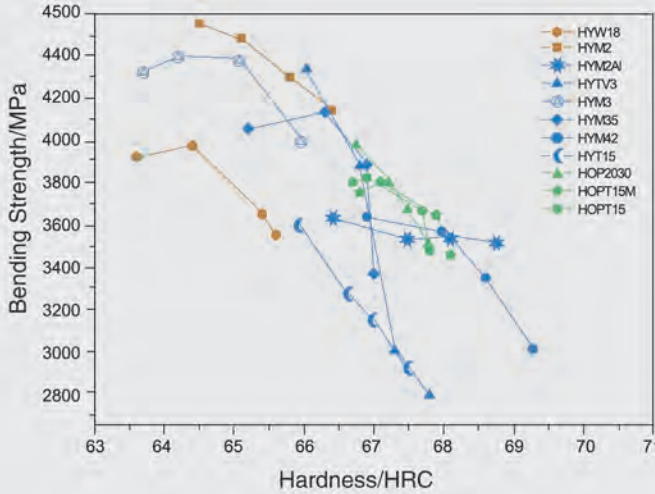
Characteristics



Impact Toughness



Bending Strength



Grade Recommendations

Application		Durability		
		For general use	For hard material cutting	For high speed heavy duty cutting
General cutter	Hole-machining tool	HYM2 / HYW9	HYM35 / HYM42	HOP系列
	Threading tool	HYTM2 / HYM2 / HYM7	HYM35 / HYTV3	HOP2030
	Milling cutter	HYM2 / HYM2AI	HYM35 / HYM42	HOP2030
Complicated cutter	Gear cutter(Hob, Shaper cutter, Shaving cutter)	HYM2	HYM35 / HSF825K / HOP2030	HOPT15/HOPT15M
	Broaching cutter(Broach)	HYM2 / HYM32 / HSF620	HYM35 / HSF825K	HOPT15 / HSF835
Saw/ blade	Sawing cutter-Power hacksaw blade	HYW3 / HYW3V2 / HYW4	HYM2	HYM35
	Bandsaw blade	HYM2	HYM3 / HYM42	HYT42 / HOP2030
	Circular saw blade	HYM2 / HYM32	HYM35 / HYM42	HOP2030
	Hand saw, Scroll saw	HYW3 / HYW3V2 / HYW4	HYM2	HYM35
	HSS blade	HYM2 / HYW18	HYM35 / HYM42	HOP2030 / HOPT15 / HSF640
Mold	Thimble	HYM2 / HYM7	HYM35 / HYM42	HOP2030 / HOP10V
	Stamping die- Punch rod	HYM2 / HYM7	HYM35 / HYM42	HOP2030 / HSF680
	Fastener series (Fine blanking)	HYM2 / HYM7	HYM3 / HYM35	HYM42 / HOPM3
Parts	Oil pump and Oil nozzle		HYM2	HOPM3/HOPM4
	Blade (Blade-pump)	HYW3V2 / HYW4	HYM2 / HYW9	

Product Form

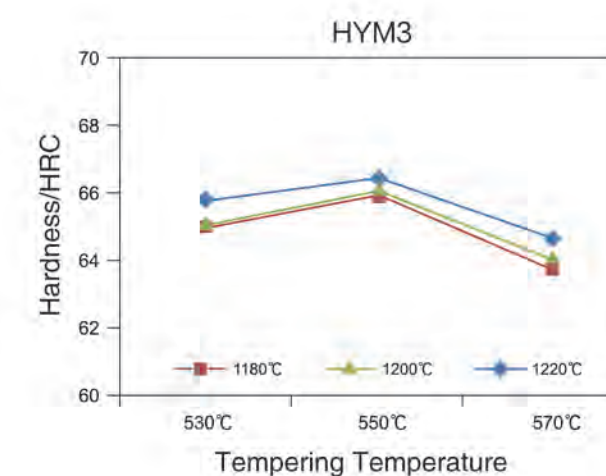
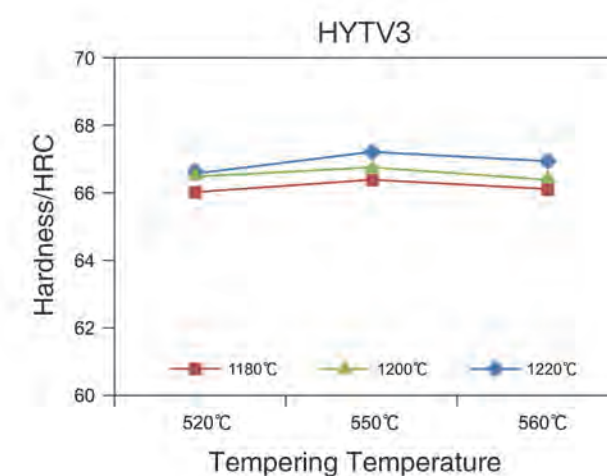
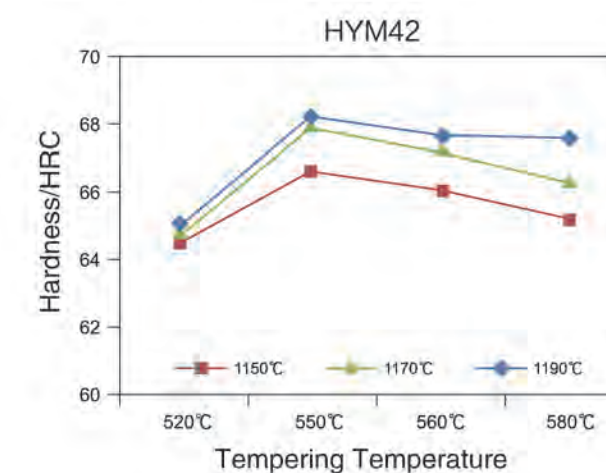
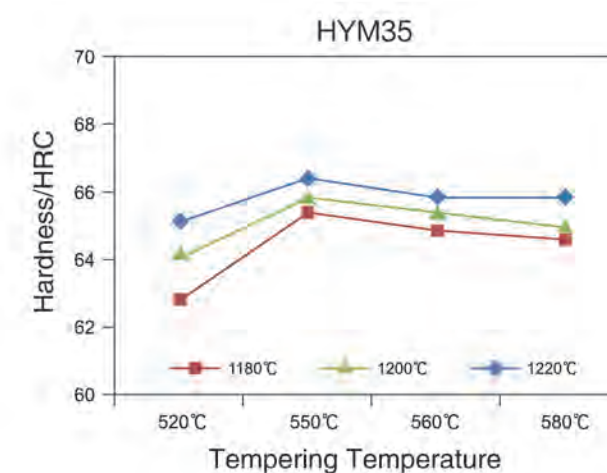
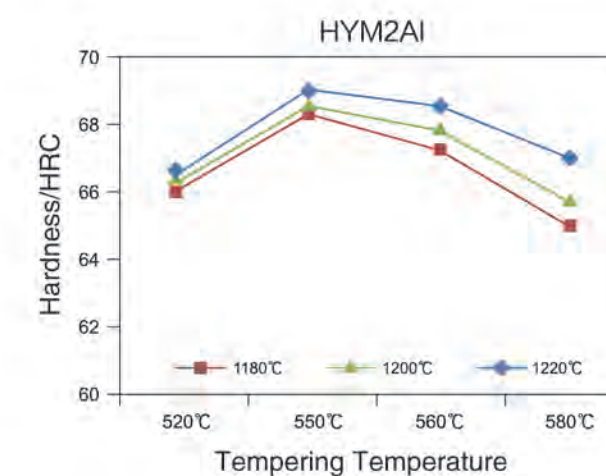
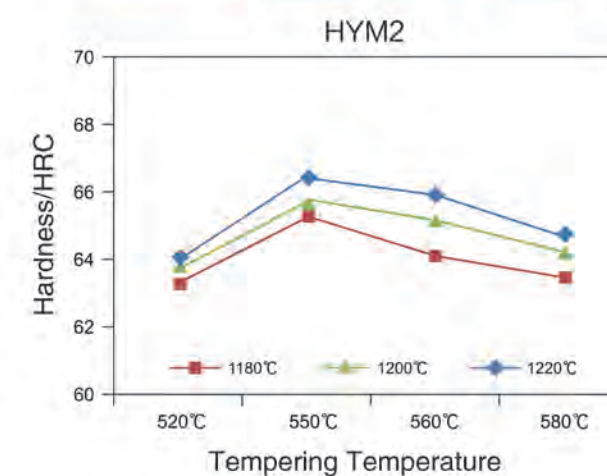
Form Supplied	Size(mm)	Surface Condition
Bar	φ 12-30	Black
	φ 30- 410	Roughly Turned
Bright Material	φ 5. 0-14. 5	Ground
	φ 12-410	Peeled
Profiled Bar	7. 2X7. 2-27X27	Black
	(3. 5-40) X (13-100)	Black/Shot Blast
	(20-200) X (40 -400)	Black/Milled
Wire Rod	φ 5. 5-17	Black/Ground
Wire	φ 0. 8-14	Black/Ground
Prehardened Bar	φ 1. 0-15. 0	Black
Strip Material	(33-65) X (1. 5-3. 0)	Black
	(25-55) X (0. 65-1. 80)	Polished
Sheet Material	(1.0-10.0) X (500-850)	Black
Forged Product	Round φ (50-350) X (10-300)	Black/Machined
	Rectangle (20-200) X (5-80)	

According to customer requirements, we can customize welded-blank, wimble blank, roller blank, hollow broacher blank and other extension product.

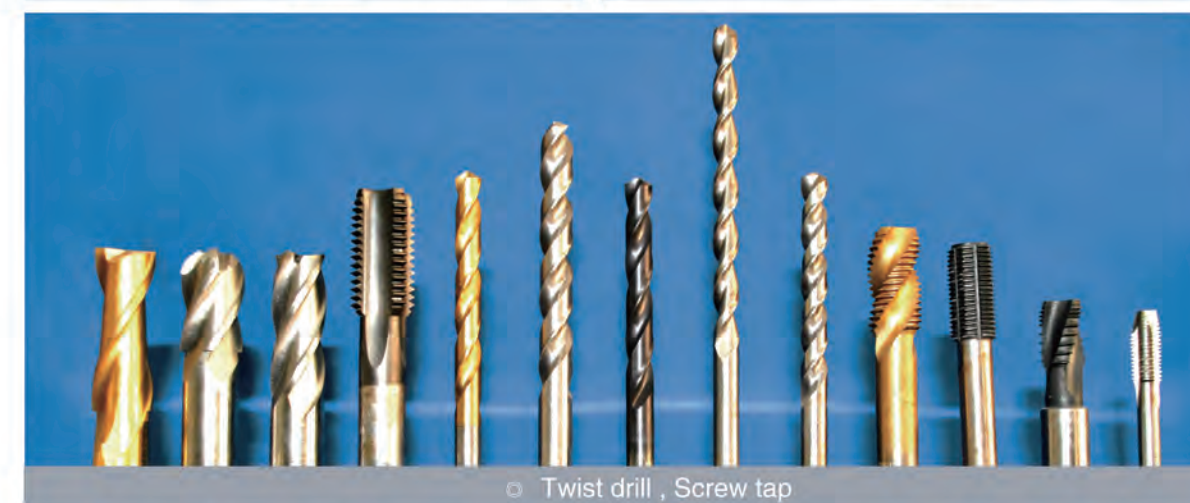
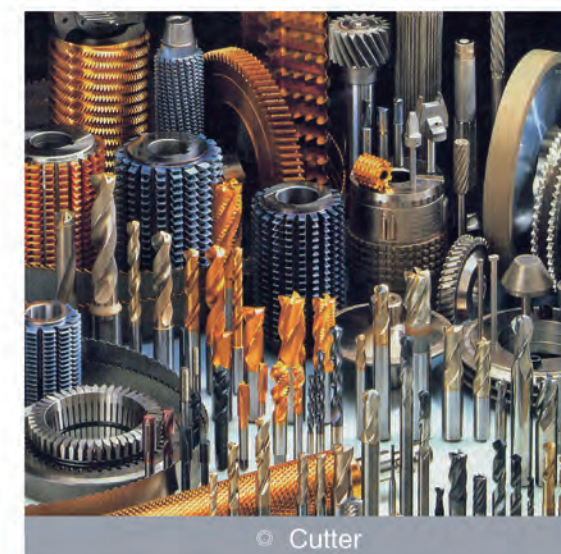
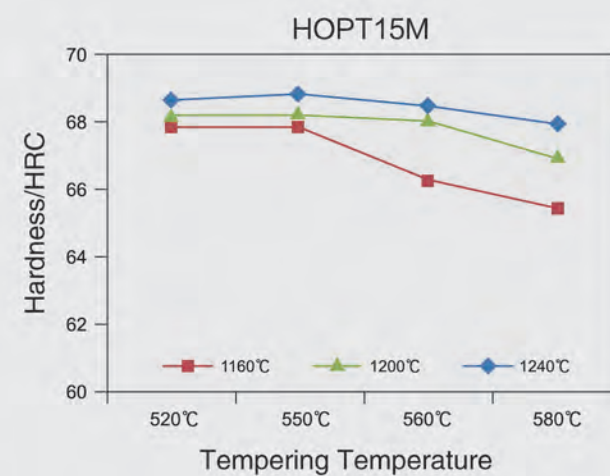
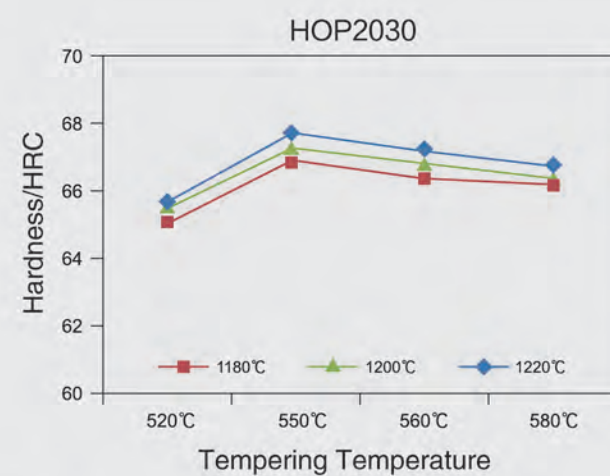
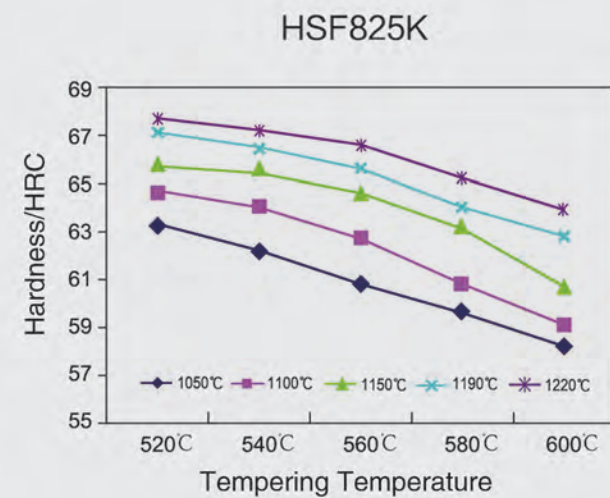
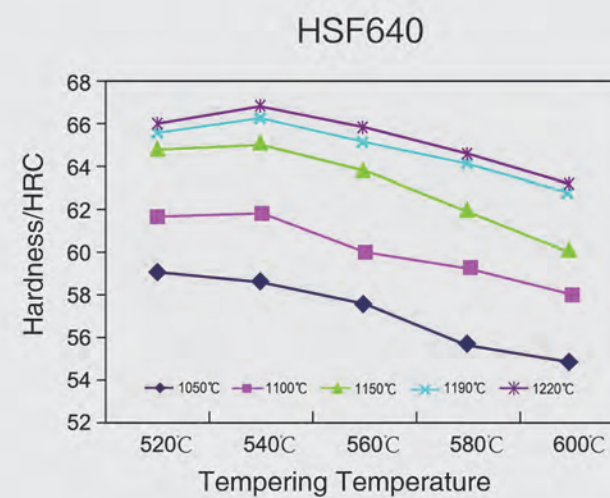
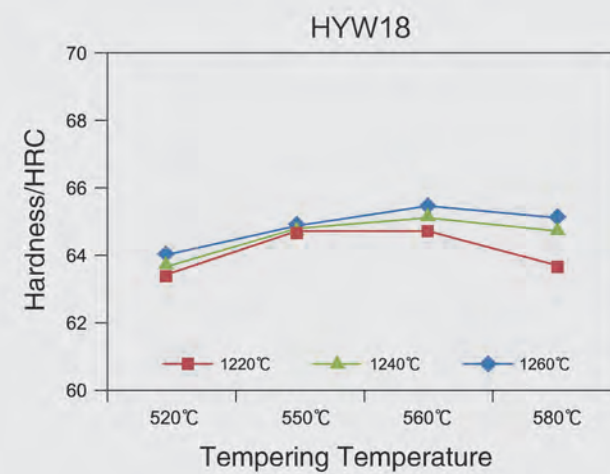
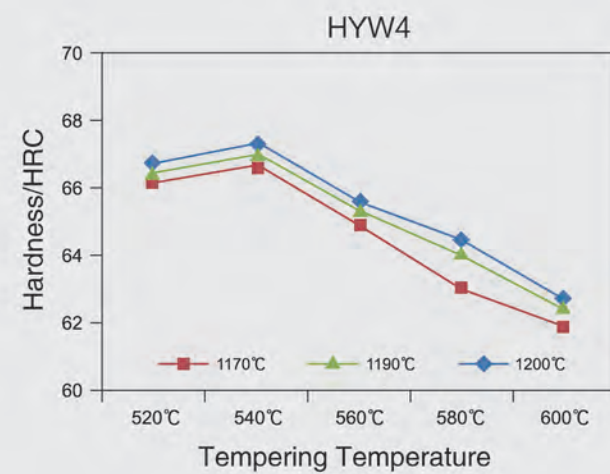
Heat Treatment Recommendations

Grade	Heat Treatment (°C)			Hardness	
	Preheating Temperature	Quenching Temperature	Tempering Temperature	Annealed Hardness (HB/≤)	Tempering Hardness (HRC/≥)
HYW18	800-900	1240-1270	540-560	255	63
HYW9	800-900	1190-1230	540-560	255	64
HYM32	800-900	1180-1220	540-560	255	65
HYM2	800-900	1180-1220	540-560	255	64
HYTM2	800-900	1180-1220	540-560	255	64
HYM7	800-900	1170-1210	550-570	255	64
HYM42	800-900	1150-1180	540-560	269	66
HYM35	800-900	1180-1220	540-560	269	64
HYT42	800-900	1190-1230	540-560	269	66
HYT15	800-900	1200-1230	530-550	269	65
HYM2AI	800-900	1190-1220	550-570	269	66
HYM3	800-900	1180-1220	540-560	269	64
HYTV3	800-900	1180-1220	540-560	269	64
HYM4	800-900	1180-1210	540-560	269	64
HYW3V2	800-900	1150-1180	540-560	255	64
HYW3	800-900	1170-1200	540-560	255	64
HYW4	800-900	1170-1200	540-560	255	64
HYM50	800-900	1100-1120	550-570	255	62
PM	As shown in the Powder Metallurgy Material brochure				
SF	As shown in the Spray Forming Material brochure				

Heat Treatment Curve



Product Application

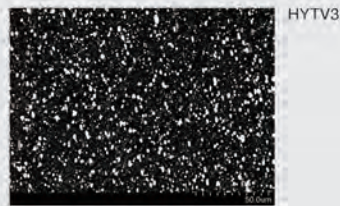
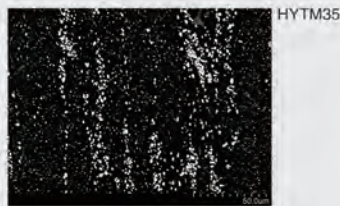
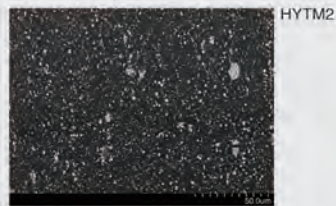


Special Steel for High Performance Tap

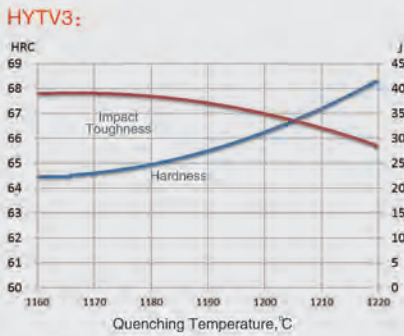
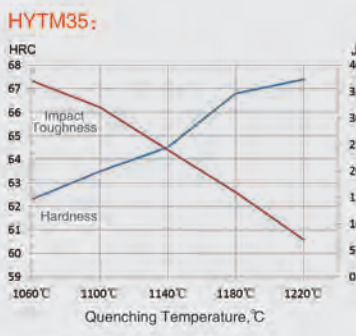
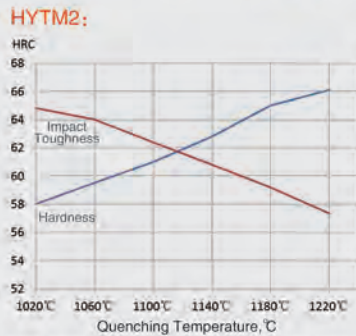
Summary

HEYE high speed steel special for high performance tap is produced by a variety of off-furnace refining treatment and vacuum VD and other special smelting processes, and provides a uniform dispersion of carbide particles throughout the structure. It has excellent machinability and heat treatment responsiveness, the uniform fine carbide particles ensure that the material has good wear resistance and excellent grindability.

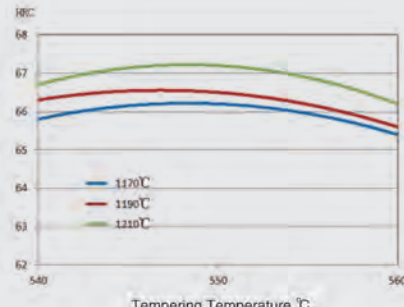
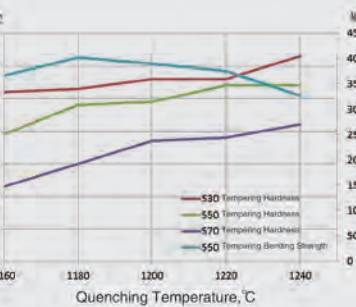
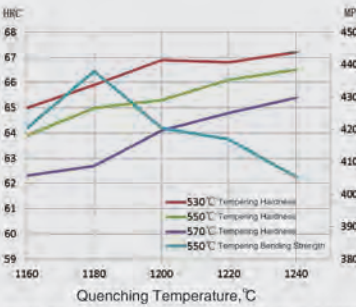
- Precise chemical composition control
 - High purity
 - The excellent properties of hot and cold processing technology
- Reasonable allocation of alloy proportion and carbon saturation
 - Fine and uniform dispersion of carbide particles
 - Excellent heat treatment performance



Mechanical Properties



Note: Temper twice at 560°C, each time for 1 hour, with non-notch impact specimen 10*10*55mm.



Note: The size of bending test specimen is $\phi 5 \times 100\text{mm}$.

Hardness Curve and Heat Treatment

Annealing: Heat to 860–880°C, hold 2–4 hours, then furnace cool to 600°C at 10–30°C/h.

Stress relief annealing: Heat to 600–700 °C, hold 2 hours, and then cool down in the furnace.

Quenching: Two-stage preheating, the temperature is 400–500°C and 850–900°C, austenitizing at the desired hardness temperature, heating coefficient 10–15sec/mm; fractional quenching at 580–620°C, and then cool in still air.

Tempering: Temper at 540–560°C, 3 times, 1 hour each time, cool in still air.

Chemical Composition

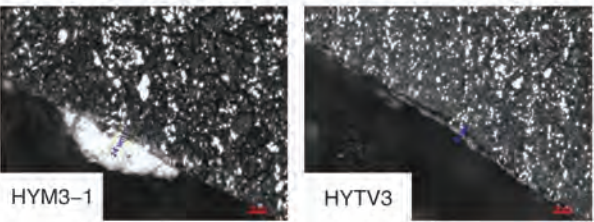
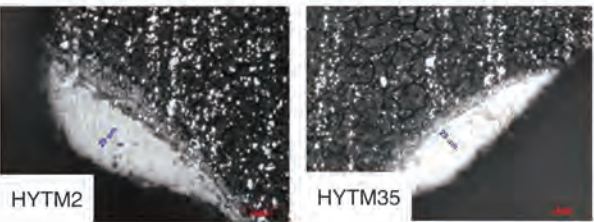
Grade	C	Cr	Mo	V	W
HYTM2	0.9	4	5	2	6
HYTM35	0.9	4	5	2	6
HYTV3	1.2	4	6	3	5

Characteristics

Grade	Hardness	Toughness	Wear Resistance	Grindability
HYTM2	Good	Good	Good	Good
HYM3	Good	Good	Good	Good
HYTV3	Good	Good	Good	Good
HYTM35	Good	Good	Good	Good
HYM42	Good	Good	Good	Good
HOP2030	Good	Good	Good	Good

Grindability comparison

The comparison of grinding burns is as follows:



Grindability : HYTV3 > HYTM35=HYTM2 > HYM3-1。

Supply Type and Status

Form Supplied	Size(mm)	Surface Condition
Bar	$\phi 12-30$ $\phi 30-410$	Black Roughly Turned
Bright Material	$\phi 5.0-14.5$ $\phi 12-410$	Ground Peeled
Profiled Bar	7, 2X7, 2-27X27 (3, 5-40) X (13-100)	Black Black/Shot Blast
Wire Rod	(20-200) X (40-400)	Black/Milled
Wire	$\phi 5.5-17$	Black/Ground
Prehardened Bar	$\phi 1.0-15.0$	Black/Ground
Strip Material	(33-65) X (1.5-3.0) (25-55) X (0.65-1.80)	Black Polished
Sheet Material	(1.0-10.0) X (500-850)	Black
Forged Product	Round ϕ (50-350) X (10-300) Rectangle (20-200) X (5-80)	Black/Machined

Supply Condition:

Cold-drawn material, Hardness $\leq 310\text{HB}$

Annealed, Annealing hardness: HYTM2 $\leq 255\text{HB}$, HYTM35, HYTV3 $\leq 269\text{HB}$.

Implementation Standard: Relevant technical inspection according to GB/T 9943-2008

Packing and Storage

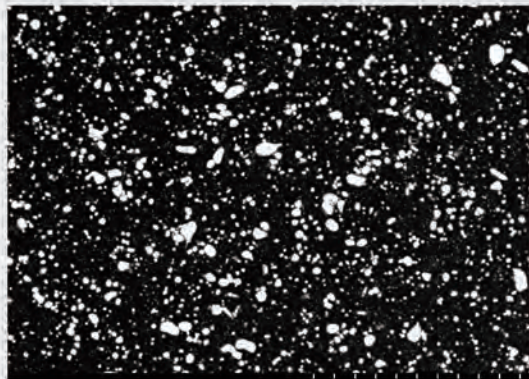
According to GB/T 2101 General requirement of acceptance, packaging, marking and certification for section steel.

HYPM42 Special Steel for Punch

Summary

Heye high speed steel special for high performance punch is produced by a variety of off-furnace refining and vacuum VD and other special smelting processes, and provides a dispersion of carbide particles throughout the structure. It is a special steel for punch (precision metal punching). Based on service conditions and analysis of failure modes, the composition was redesigned, and a unique process was adopted to meet the requirements of high toughness and high impact performance.

- Fine carbide particles
- Better red hardness
- Excellent toughness
- Excellent impact performance



HYPM42

Chemical Composition

C	Cr	Mo	V	W	Co
1.06	3.80	9.30	1.20	1.40	8.00

Similar Grade

GB	ISO	EN/DIN
W2Mo9Cr4VCo8	HS2-9-1-8	S2-10-1-8
ASTM	JIS	
M42	SKH59	

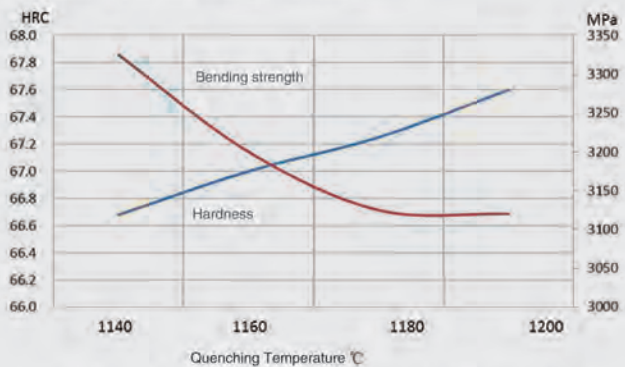
Physical Properties

Item	Temperature, °C		
	20	400	600
Density, g/cm ³	8.03	7.93	7.87
Elasticity modulus, GPa	225	200	180
Coefficient of thermal expansion, mm/mm°C × 10 ⁻⁶ , 20°C to	-	11.5	11.8
Thermal conductivity, W/(m°C)	24	28	27
Specific heat, J/kg°C	420	510	600

Mechanical Properties

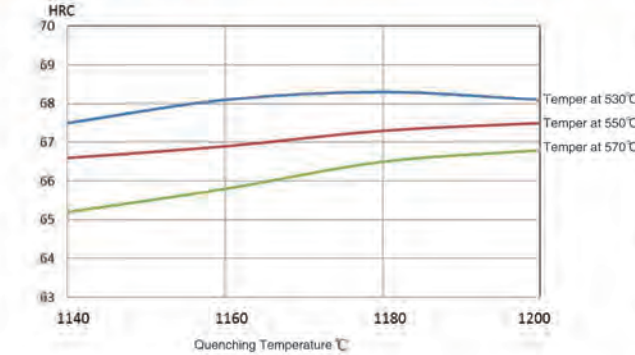


Note: Temper three times at 560°C, and hold 1 hour each time, with non-notch impact specimen 10*10*55mm.



Note: Temper three times at 550°C, and hold 1 hour each time, the size of bending test specimen is φ 5*100mm.

Hardness Curve and Heat Treatment Supply Type and Status



Form Supplied	Size (mm)
Hot rolled round bar	φ 12-95
Cold drawn material	φ 0.8-14

Supply Condition: Annealed, Annealing hardness ≤250HB
Implementation Standard: Relevant technical inspection according to GB/T 9943-2008

Heat Treatment
Annealing: Heat to 860-880°C, hold 2-4 hours, then furnace cool to 500°C at 10-20°C/h.
Stress relief annealing: Heat to 600-700 °C, hold 2 hours, then cool down in the furnace.
Quenching: Two-stage preheating, the temperature is 400-500°C and 850-900°C, the austenitizing temperature is 1140-1180°C, heating coefficient 10-15sec/mm; fractional quenching at 580-620°C, and then cool in the still air.
Tempering: Tempering temperature 530-560°C, tempering 3-4 times, 1 hour each time, larger size can be used 60min/25mm, cool in the still air.

Characteristics

Grade	Hardness	Toughness	Wear Resistance	Grindability
HYPM2				
HYM3				
HYPM35				
HYPM42				

Heat Treatment Recommendations

Tool Type	Quenching Temperature, °C	Tempering Temperature, °C
Punch	1140-1160	550-560

Packing and Storage

According to GB/T 2101 General requirement of acceptance, packaging, marking and certification for section steel.