



POWDER METALLURGY MATERIAL

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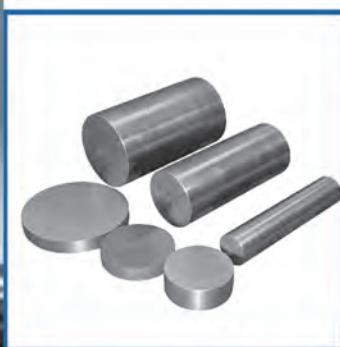


河冶科技股份有限公司
HEYE SPECIAL STEEL CO.,LTD.

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

PM

Powder Metallurgy Material



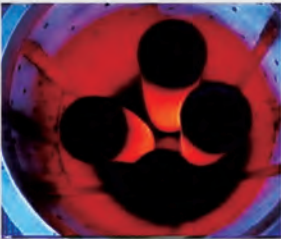
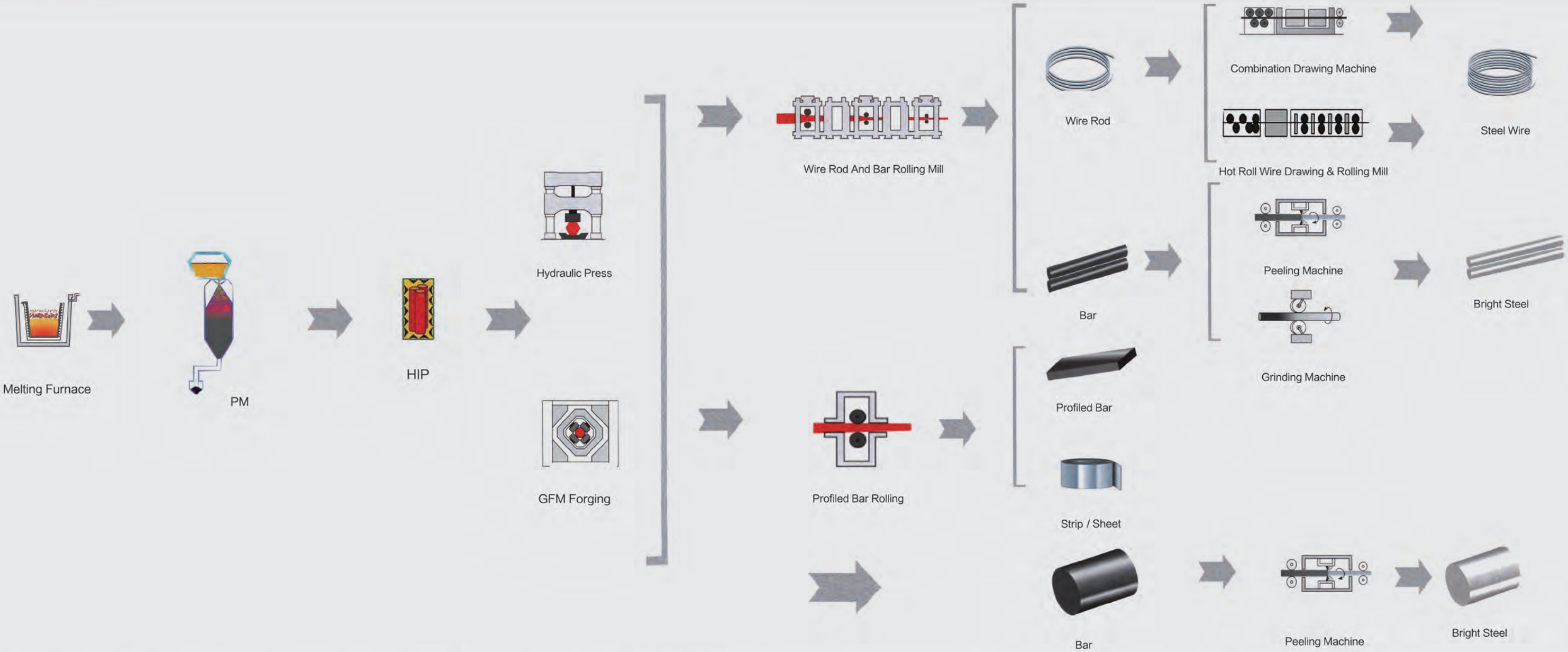
Material Series

Grade	Similar Grade				Chemical Composition (Wt%)						Properties Comparison			
	ISO/EN	ASTM	JIS	DIN	C	Cr	W	Mo	V	Co	Wear Resistance	Red Hardness	Toughness	Grindability
HOPM3	HS 6-5-3C	M3 Cl.2	SKH53	1.3344	1.3	4	6	5	3	-				
HOPM4	HS 6-5-4	M4		1.3351	1.4	4	6	5	4	-				
HOPT15	HS 12-0-5-5	T15	SKH10	1.3202	1.6	4	12	-	5	5				
HOPT15M	HS 10-2-5-8				1.6	5	10	2	5	8				
HOP2030	HS 6-5-3-8		SKH40	1.3244	1.3	4	6	5	3	8				
HOP2060	HS 7-7-7-11				2.3	6.5	6	6.5	7	10.5				

Characteristics

Grade	Characteristics
HOPM3	The steel belongs to tungsten-molybdenum high speed steel, with greater wear resistance and improved toughness when used for cutting and cold working.
HOPM4	The steel belongs to tungsten-molybdenum high speed steel, with greater wear resistance and improved toughness when used for cutting and cold working.
HOPT15	The steel belongs to tungsten series high vanadium cobalt high speed steel, which has high hardness, high wear resistance and good red hardness. It is an ideal material for manufacturing cutting tools for high hardness materials.
HOPT15M	The steel belongs to tungsten-molybdenum high vanadium and high cobalt high speed steel, which has high hardness, high wear resistance and good red hardness. It is an ideal material for manufacturing cutting tools for high hardness materials.
HOP2030	The steel belongs to high performance high speed steel containing cobalt, which has better wear resistance, toughness and red hardness, and good machinability. It is a powder high speed steel with very good comprehensive performance and wide use.
HOP2060	The steel belongs to tungsten-molybdenum high vanadium and high cobalt high speed steel, which has high hardness, super wear resistance and excellent red hardness. It is an ideal material for manufacturing tools for cutting extremely hard materials.

Process



HP Furnace



Hydraulic Press



GFM forging



Wire Rod And Bar Rolling Mill



Production line for heavy coil



Peeling Machine CPM-075



Peeling Machine BPC-5000

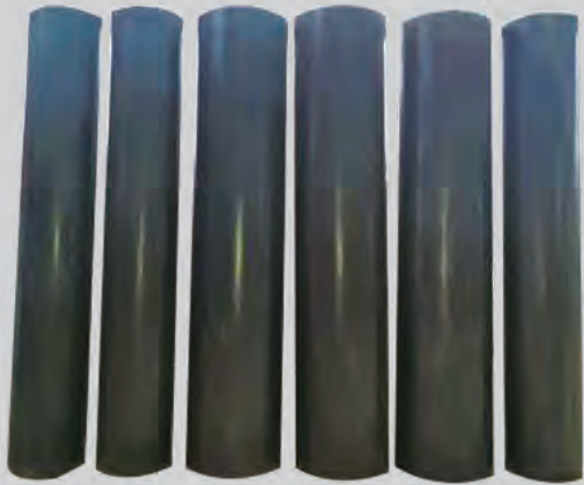


Laser Particle Size and Shape Analyzer

Properties of Powder Metallurgy Material

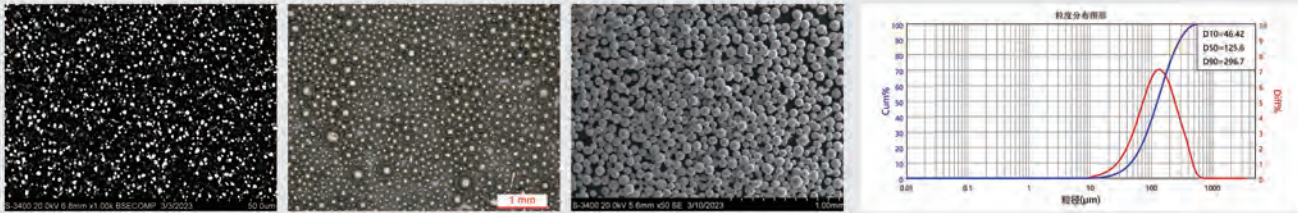
HEYE PM materials are made by gas atomization powder making + hot isostatic pressing process, The gas atomization powder making line which designed and manufactured with complete independent intellectual property rights, initiates the large-scale production of PM tool and mold materials in China for the first time!

HEYE adheres to the strict requirements and precise quality control ,and produces the PM tool and mould materials characterized by fine carbide, uniform, no segregation, pure and isotropic organization, excellent processing performance and stable heat treatment size and other comprehensive properties.



Products Advantages

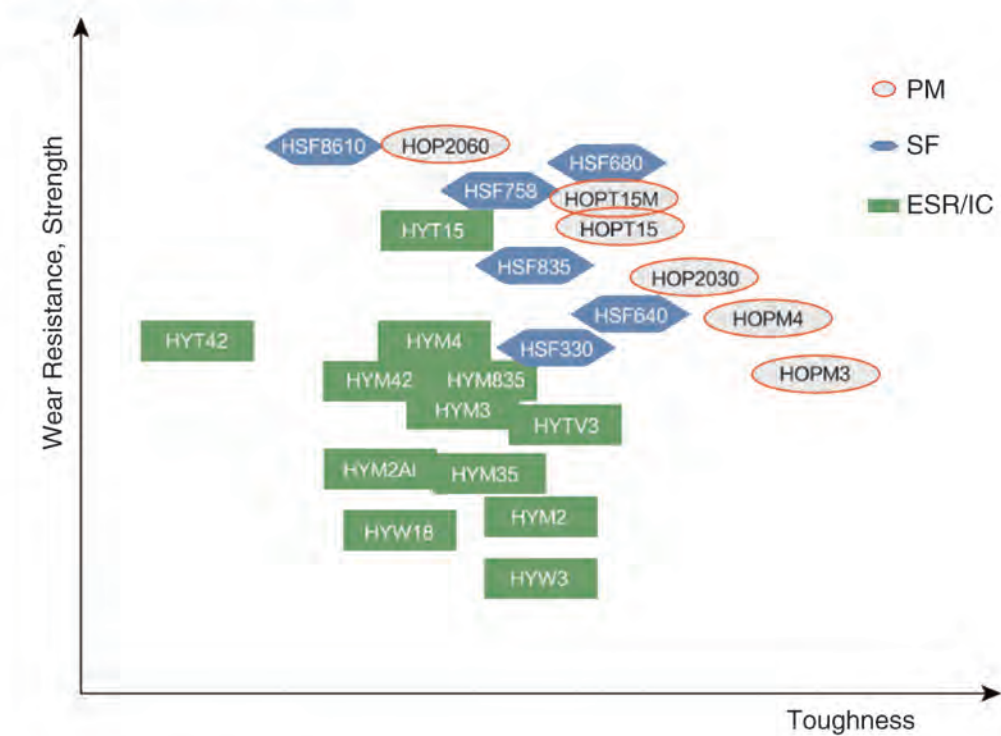
- ⊗ High cost performance, excellent comprehensive performance, competitive price;
- ⊗ Short delivery time;
- ⊗ Suitable for customization, small batch, high quality, fast delivery;
- ⊗ Fully independent design and manufacturing.



Heat Treatment Recommendations

Grade	Heat treatment			Hardness		Typical Application
	Preheating Temperature(℃)	Quenching Temperature(℃)	Tempering Temperature(℃)	Annealing Hardness (≤HB)	Tempering Hardness (≤HRC)	
HOPM3	800-900	1180-1220	540-560	280	65	Fastener moulds, Precision stamping moulds, Oil pump and Oil nozzle
HOPM4	800-900	1180-1220	540-560	280	65	Milling cutter, Oil pump and Oil nozzle, Wear-resistant parts
HOPT15	800-900	1190-1230	540-560	300	66	Broaching cutter, blade
HOPT15M	800-900	1190-1220	540-560	300	67	Cutting tool, Threaded cutter
HOP2030	800-900	1160-1200	540-560	300	67	Threaded cutter, Milling cutter, Bandsaw blade, saw blade, blade, Thimble, Stamping die
HOP2060	800-900	1150-1190	540-560	340	67	Cutting tool

Characteristics



Product Form

Form Supplied	Size (mm)	Surface condition
Round Bar	φ12-30	Black
	φ30- 410	Roughly Turned / Black
Bright Bar Material	φ5. 0-14. 5	Ground
	φ12-410	Peeled
Square Bar	7. 2X7. 2-27X27	Black
Flat Bar	(3. 5-40) X (13-100)	Black/Shot Blast
	(20-200) X (40 -400)	Black/Milled
Wire Rod	φ5. 5-17	Black/Ground
Drawn Wire	φ0. 8-14	Black/Ground
Prehardened Bar	φ1. 0-15. 0	Black
	(33-65) X (1. 5-3. 0)	Black
Strip Material	(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)	

HOP2030 Powder Metallurgy High Speed Steel

Summary

HOP2030 is made by powder metallurgy technology, with excellent wear resistance and good red hardness.

- No segregation, fine grain, fine carbide
- Good hot workability
- High grindability
- Excellent dimensional stability

Chemical Composition

C	W	Mo	Cr	V	Co
1.3	6.4	5.0	4.2	3.0	8.4

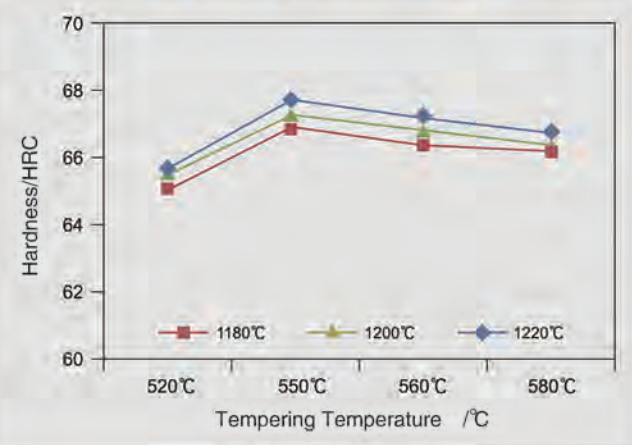
Typical Application

- High performance tap
- Band saw blade
- Punch
- High temperature bearing
- Die cutting tool roll

Physical Properties

Item	Index
Density, g/cm ³	8.05
Elasticity modulus, Gpa	240
Coefficient of thermal expansion, mm/mm℃ × 10 ⁻⁶ (0 ~ 600℃)	12.3

Hardness Curve and Heat Treatment



Heat Treatment

- **Annealing**
Heat to 850–900℃, hold 2–4 hours and then furnace cool to 600℃ at 10℃/h.
- **Stress relief annealing**
Heat to 600–700℃, hold 2 hours, slowly furnace cool to 500℃.
- **Quenching**
Two-stage preheating, temperature is 815–845℃ and 1010–1040℃, austenitizing temperature is 1050–1200℃, salt, oil or air quench below 595℃, uniform air cooling to room temperature. Rapid cooling from 1010℃ to 705℃.
- **Tempering**
Temper immediately after quenching at 530–600℃, two to three times for at least 2 hours each time, and cool to room temperature in between.
- **Heat treatment system recommendation**
Cutting tool with 1130–1200℃ (recommended 1150–1180℃, hardness in 65–68HRC), cold die steel with 1020–1120℃ (recommended 1050–1100℃ hardness in 62–64HRC). Salt bath treatment will obtain the maximum toughness in the hardened state. Recommended 560℃ tempering, tempering three times, each time 1 hour.

Mechanical Properties

Quenching Temperature, ℃	Hardness, HRC	Impact Toughness, J
1150	66	46
1170	67	42
1190	68	39

Note: Tempering process: 560℃ × 1 hour, 3 times

Packaging and Storage

According to GB/T 2101 *General Principle Provisions for Acceptance, Packaging, Marking, and Quality Certificate of Steel Sections*.

Supply Type and Status

Form Supplied	Size (mm)	Surface Condition
Bright Bar	φ5.0-14.5	Ground
	φ12-240	Peeled
Round Bar	φ12-30	Black
	φ30-240	Roughly Turned
Square Bar	7.2×7.2-27×27	Black
Flat Bar	(3.5-40) × (13-100)	Black/Shot Blast
	(20-200) × (40-300)	Black/Milled
Wire Rod	φ5.5-17	Black/Ground
Drawn Wire	φ0.8-14	Black/Ground
Strip Material	(33-65) × (1.5-3.0)	Black
	(25-55) × (0.65-1.80)	Polished
Forged Product	Round φ (50-300) × (10-300)	Black/Machined
	Rectangle φ (20-200) × (5-80)	

Supply status: annealed state, annealed hardness ≤ 300 HB.
Implementation standard: T/CSTM 00348–2021
General Principle Provisions for Acceptance, Packaging, Marking, and Quality Certificate of Steel Sections.

Characteristics

Grade	Hardness	Toughness	Wear Resistance	Grindability
M2				
M42				
HYTV3				
HOP2030				
HOPT15				
HOPT15M				

HOPT15M Powder Metallurgy High Speed Steel

Summary

HOPT15M is made by powder metallurgy process. It belongs to tungsten-molybdenum high vanadium and high cobalt high speed steel, with extremely high wear resistance and red hardness. HOPT15M is the ideal material for manufacturing and machining extra hard or difficult cutting materials.

- No segregation, fine grain, fine carbide
- Good machinability
- High grindability
- Excellent dimensional stability

Chemical Composition

C	W	Mo	Cr	V	Co
1.6	10.0	2.2	4.7	4.8	8.0

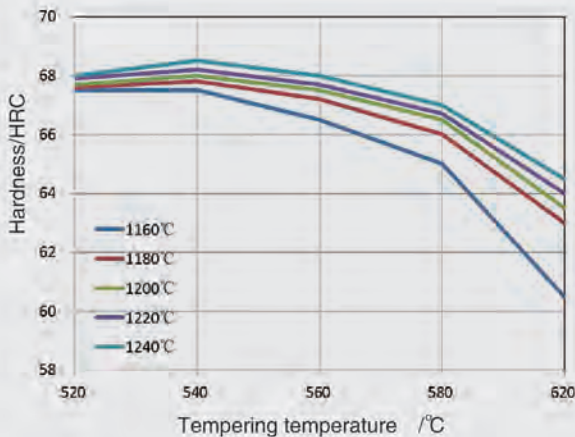
Typical Application

- High performance gear tool
- End milling cutter
- Screw tap
- Milling cutter

Physical Properties

Item	Index
Density, g/cm ³	8.10
Elasticity modulus, Gpa	217
Coefficient of thermal expansion, mm/mm℃ × 10 ⁻⁶ (0 ~ 600℃)	11.7

Hardness Curve and Heat Treatment



Heat Treatment

- **Annealing**
Heat to 770–840℃, hold 4 hours , then slow cooling to 740℃ for 2 hours in the furnace.
- **Stress relief annealing**
Heat to 600–650℃, hold 2 hours and then cool down in with the furnace.
- **Quenching**
Two-stage preheating, temperature is 815–845℃ and 1010–1040℃, austenitizing temperature is 1160–1230℃, salt, oil or air quench below 600℃, uniform air cooling to room temperature. Vacuum or controlled atmosphere quenching, slightly lower hardness, suitable for large size workpiece. The range of 1010℃ to 705℃ is rapidly cooling, while slow cooling below 540℃ has the smallest deformation.
- **Tempering**
Temper immediately after quenching, two to three times at 550–560℃, each time for at least 2 hours, cooling to room temperature between tempering. Size change before and after heat treatment: +0.15%.
- **Heat treatment system recommendation**
1200–1220℃ quenching is used when high hardness is required, and lower quenching temperature is used when high toughness is required. The recommended tempering temperature is 560℃.

Mechanical Properties

Quenching Temperature, ℃	Hardness, HRC	Impact Toughness, J
1180	67	44
1200	67.5	39
1220	68	36

Note: Tempering process: 560℃ × 1 hour, 3 times

Supply Type and Status

Form Supplied	Size (mm)	Surface Condition
Round Bar	φ 12–240	Peeled
	φ 12–30	Black
	φ 30–240	Roughly Turned
Forged Product	Round φ (50–300) × (10–300)	Black/Machined
	Rectangle(20–200) × (5–80)	

Supply status: annealed state, annealed hardness ≤ 300 HB.
Implementation standard: T/CSTM 00348–2021 Powder Metallurgy High Speed Tool Steel.

Characteristics

Grade	Hardness	Toughness	Wear Resistance	Grindability
M2				
M42				
HYTV3				
HOP2030				
HOPT15				
HOPT15M				