

SPRAY FORMED HIGH SPEED STEEL HSF755



Chemical Composition

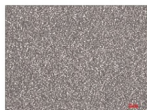
Chemical Composition%	C	Cr	W	Mo	V	Co
	1.55	4.50	12.4	≤1.0	4.90	5.00
Delivery Status	Soft annealing, Hardness ≤280HB					

Similar Grades

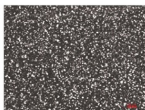
Standard	Erasteel	Crucible	ASTM	ISO
Grades	ASP2015	CPM T15	T15	HS12-0-5-5

Microstructures and Properties

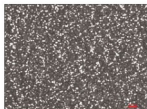
Microstructure of spray formed high speed steel after forging is fine and uniform, resulting in good mechanical properties and heat treatment response. The lifetime of spray formed high speed steel is much better than high quality ESR high speed steel at the same hardness and closed to PM high speed steel. Microstructures of SF HSS and PM HSS are compared below.



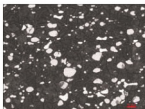
Carbide structure of PM T15



Carbide structure of HSF755



Carbide size of PM T15

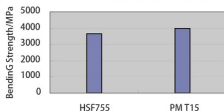


Carbide size of HSF755

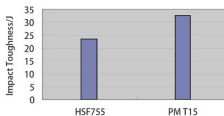
Quality parameters: The tensile strength of spray formed HSF755 with ultra-fast solidification is quite near to that of PM T15, and toughness is about 30% lower than PM T15. It has high impact wear resistance, excellent hardenability and hardness stability or tempering resistance, and isotropy of microstructure and property.

The carbide size of PM T15 steel is 1-3 μm and that of HSF755 is 1-10 μm. Because of the combination of different sizes of carbide, the wear resistance of the spray-formed steel improves by 40-50%.

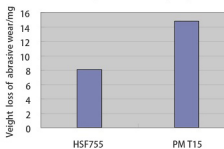
Comparison of bending strength



Comparison of impact toughness



Comparison of wear capacity



Material Feature

HSF755, a high W-V-Co high speed steel, is widely used in the tool and die manufacturing because of good processing performance as well as high hardness and toughness. It is not only for manufacturing various types general tool, but also large and thermoforming tools.

- Tight chemical composition
- Rational design of alloy and carbon saturation degree
- High purity
- Fine and uniform carbide morphology
- Excellent hot and cold processing performance
- Excellent heat treatment

SPRAY FORMED HIGH SPEED STEEL HSF755



Physical Properties

Temperature	20°C	400°C	600 °C
Density kg/m ³	8200	8100	8000
Modulus of elasticity MPa	245 000	220 000	195 000
Thermal expansion ratio /°C	-	11.0x 10 ⁻⁶	11.7x 10 ⁻⁶
Thermal conductivity W/m °C	24	28	27
Specific heat J/kg°C	420	510	600

Application

- Broaches and hobs
- Milling cutters
- Shaper cutters
- Endmills

Product Sizes

Forms supplied	Size Range (mm)
Forged round bar	Φ 95 - 300
Hot-rolled round bar	Φ 8 - 95
Hot-rolled wire rod	Φ 5.5 - 17
Hot-rolled square bar	7.2 × 7.2-25.5 × 25.5
Hot-rolled flat bar	(3.5 - 20) × (16 - 65)
Hot-rolled strip	(1.5 - 3.0) × (35 - 65)
Forged product	Round Φ (50 - 300) × (10 - 300)
	Square Φ (20-200) × (5-80)

Heat Treatment

- Soft annealing

Soft annealing in a protective atmosphere at 870-900°C for 2-4h followed by slow cooling at 10°C/h down to 600°C, then air cooling.

- Stress relief

Holding at 600-700°C for 2 hrs and then cooling down with furnace.

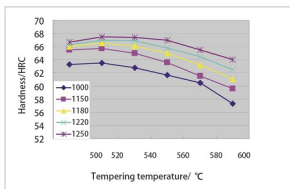
- Hardening

Hardening in a protective atmosphere with pre-heating in 2 steps at 450-500°C and 850-900°C and austenitising at a temperature suitable for chosen working hardness. Cooling down to 40-50°C.

- Tempering

3-4 times at 550-570°C are recommended with at last 1 hour holding time each time. Cooling to room temperature between temperings.

- Heat treatment curve



- Heat treatment guide

Tool	Hardening°C	Tempering°C
Single-edge cutting tools	1220-1235	550-570
Multi-edge cutting tools	1170-1220	550-570
Mould	1050-1150	550-570

Surface Treatment

High hardness surface of the tool can be generated by nitriding and carbonitriding which can improve wear and adhesion resistance. HSF755 is a good substrate material for PVD and CVD. If nitriding is requested all zone of 2-15um is recommended.