powderTEC®

PM-steel *with* choice

OB-PM-S69

HIGH SPEED STEEL

OBERSTE-BEULMANN *powderTEC®*: MAXIMUM PERFORMANCE. MAXIMUM PRECISION.

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4TH-GENERATION POWDER-METALLURGICAL STEEL

OB-PM-S69 is a powder metallurgically produced, high-carbon W-Mo-V alloyed standard high-speed steel. It has a higher toughness than the conventionally produced 1.3343 (AISI M2, DIN S 6-5-2) and due to its 4% vanadium content a higher wear resistance than grade 1.3344 (AISI M3/2, DIN S6-5-3).

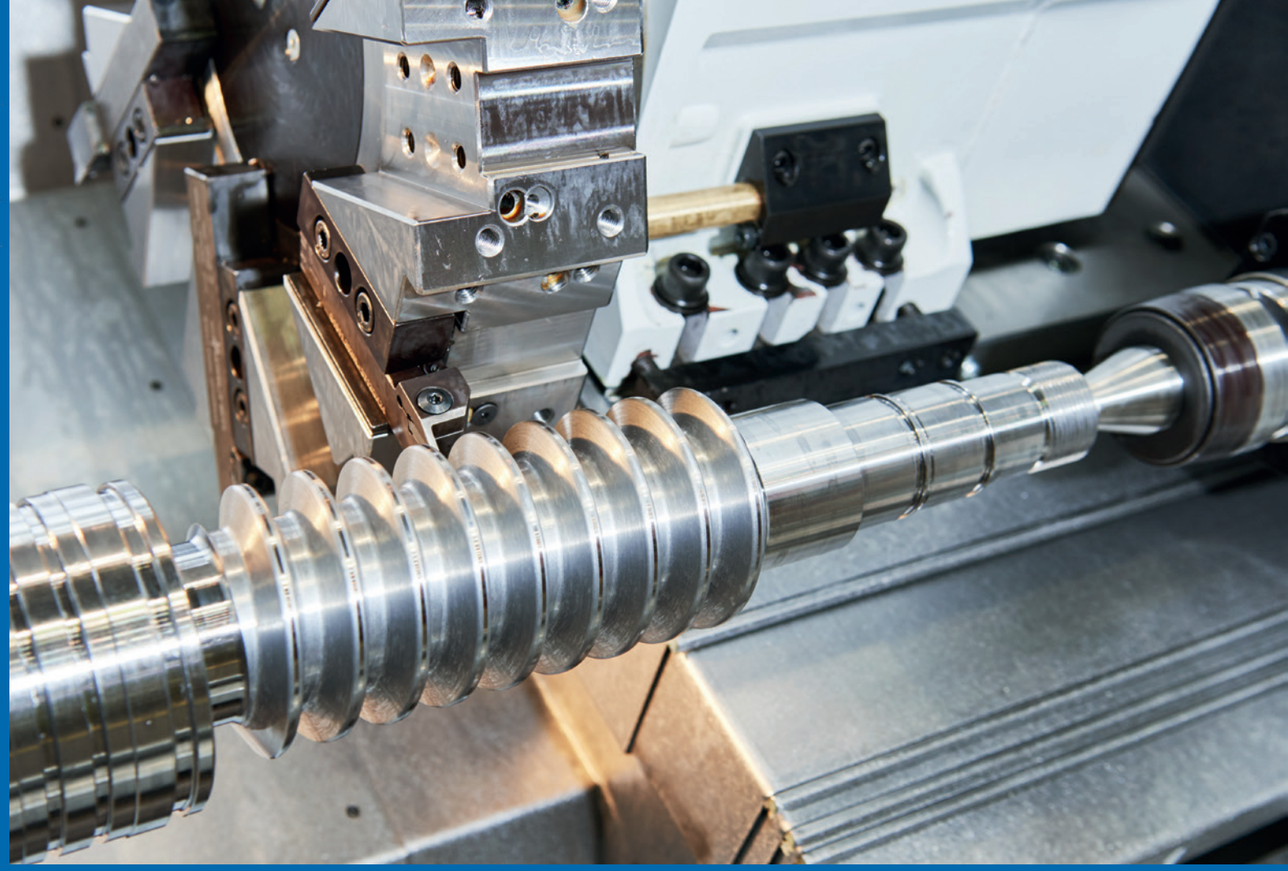
This versatile grade is rounded off by its good machinability and grindability, good compressive strength and edge stability.

OB-PM S69 is excellently suited for PVD and CVD coatings as well as bath, gas and plasma nitriding.

ADVANTAGES AND BENEFITS

– High-speed steel produced by means of a powder metallurgical process
– Good hot hardness
– Good compressive strength
– Good wear resistance

Product merits:
– Very good workability
– Excellent grindability
– High compressive strengt
– High edge stability



Top: OB-PM-S69 allows highest precision processing and is practical for many different tool types.

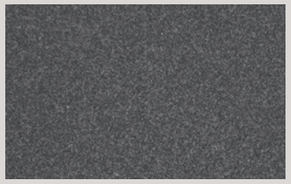
Bottom left: OB-PM-S69 is suitable for cutting tools und industrial knives, as well as for fine blanking tools.

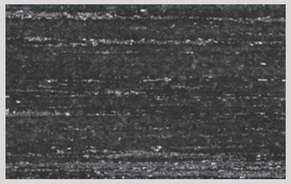
Bottom right: OB-PM-S69 offers high compressive strengt and edge stability.

APPLICATIONS

OB-PM-S69 is highly suitable for cutting, punching and fine blanking tools, pressing and forming tools, thread rolling and rolling tools, punch, shearing and industrial knives, sinter presses, broaching and milling tools as well as tapping tools.

COMPARISON OF MICROSTRUCTURE PROPERTIES





Left: Oberste-Beulmann *powderTEC®*
Right: Conventional steel

COMPOSITION

MATERIAL NO.	ABBREVIATED NAME	CHEMICAL COMPOSITION IN %									ANNEALED HARDNESS	WORKING HARDNESS
		C	Si	Mn	Cr	Mo	W	V	Co	Ni	MAX. HB	HRC
OB-PM-S69		1.40	0.60	0.30	4.10	5.00	5.80	4.00	–	–	280	59–65*

SMELTING	SPEC. WEIGHT	STATE ON DELIVERY	TENSILE STRENGTH (N/MM²)	MICROSTRUCTURE	DEGREE OF PURITY (DIN 50602)
	7.9 g/qm³	Soft-annealed			K1 max. 15

* depending on application

PHYSICAL PROPERTIES

PARAMETERS			TEMPERATURE								
			20 °C	100 °C	200 °C	300 °C	350 °C	400 °C	500 °C	600 °C	700 °C
Coefficient of thermal expansion	10^{-6} * K	(20 °C to ...)	–	11.5	11.7	12.2	–	12.4	12.7	13.0	12.9
Thermal conductivity (W/m * K)	Annealed		19.0	–	–	–	–	–	–	–	–

HEAT TREATMENT

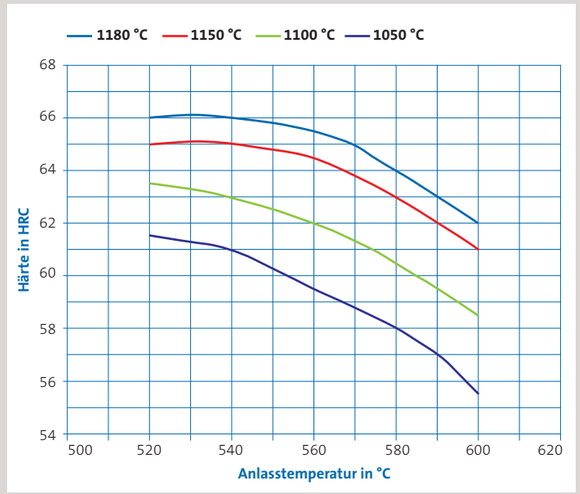
HEAT TREATMENT	TEMPERATURE (°C)	COOLING	NOTES ON HEAT TREATMENT
Stress-relief annealing	approx. 650	Furnace Air	Stress relief after extensive machining and in case of complex tools. **Holding time:** min. 4 h – controlled furnace cooling to approx. 500 °C, followed by cooling in still air.
Hardening	1080–1200		Hardening can be carried out under vacuum, in salt bath or in a furnace with a controlled (neutral) atmosphere.
Preheating stage 1 Preheating stage 2 Preheating stage 3	450–500 850–900 1000–1050		
Quenching	approx. 550	Hot bath Vacuum	Quench in **hot bath** and hold. Followed by slow cooling to lukewarm temperature in the air. **Gas pressure:** Dependent on size of part, but min. 4 bar. Then continue cooling to room temperature in still air.

TEMPERING

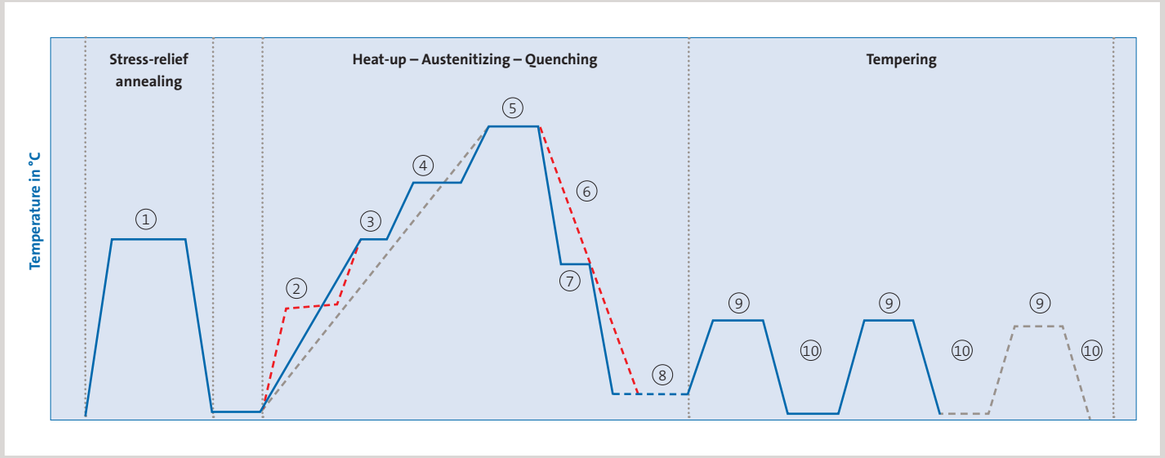
HARDNESS (HRC) AFTER TEMPERING (REFERENCE VALUE)							
	500 °C	520 °C	540 °C	560 °C	580 °C	600 °C	620 °C
1180 °C	–	66.0	66.0	**66.5**	64.5	62.0	–
1150 °C	–	65.0	65.0	**64.5**	63.0	61.0	–
1100 °C	–	63.5	63.0	**62.0**	60.5	58.5	–
1050 °C	–	61.5	61.0	**59.5**	58.0	55.5	–

Hinweise zum Anlassen

– Temper directly after quenching
– Slow heating to tempering temperature directly after hardening
– Holding time in furnace 1 h per 20 mm of workpiece thickness, but min. 2 h
– A second tempering cycle (normally at 560 °C) is necessary, a third tempering cycle is recommended
– Slow cooling to 50–80 °C to ensure transformation of residual austenite



TEMPERATURE TIMELINE (HEAT TREATMENT)



Hardening under vacuum conditions represents the state of the art

1 = Annealing temperature approx. 650 °C
2 = Pre-heating stage 1 – ½ min./mm (approx. 500 °C)
3 = Pre-heating stage 2 – ½ min./mm (approx. 850 °C)
4 = Pre-heating stage 3 – ½ min./mm (approx. 1050 °C) when high austenitizing temperatures apply
5 = Austenitizing temperature (AT) approx. 1050–1200 °C
6 = Cooling medium: Pressure gas (N_2)
7 = Hot bath approx. 550 °C (graduated quenching)
8 = Holding temperature approx. 50–80 °C (1 h/100 mm)
9 = Tempering temperature: normally 560 °C
10 = Cooling medium: Air

Note: The information contained in this brochure serves to describe the relevant products and processes; liability is excluded.

THE OBERSTE-BEULMANN *powderTEC®* RANGE:

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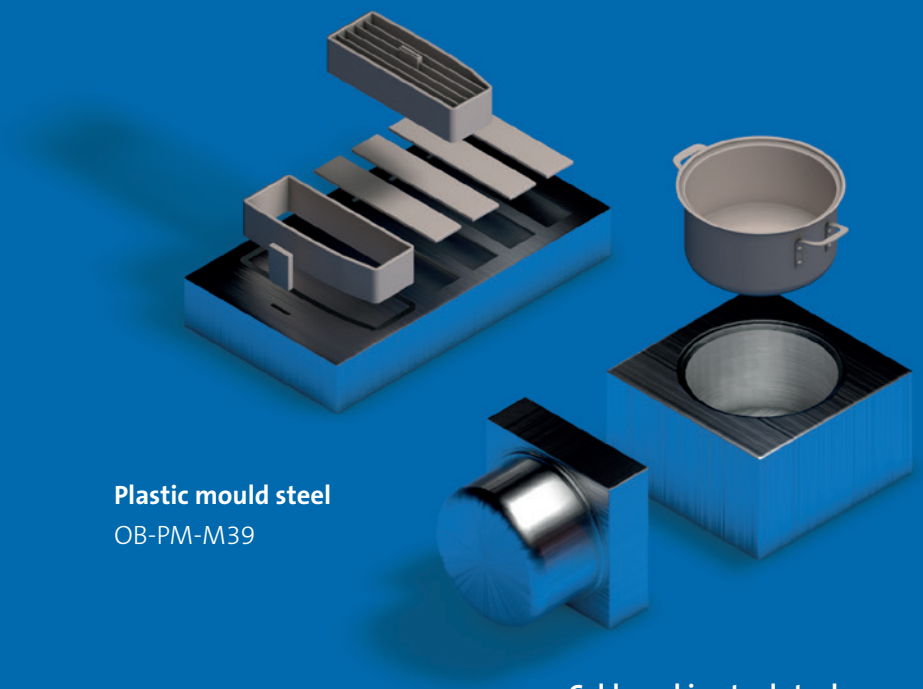
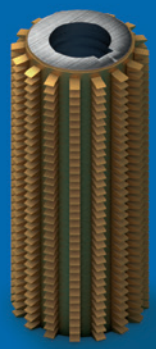


Plastic mould steel
OB-PM-M39

Cold-working tool steel
OB-PM-K09
OB-PM-K29
OB-PM-K39



High speed steel
OB-PM-S39
OB-PM-S59
OB-PM-S60
OB-PM-S69
OB-PM-S79

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