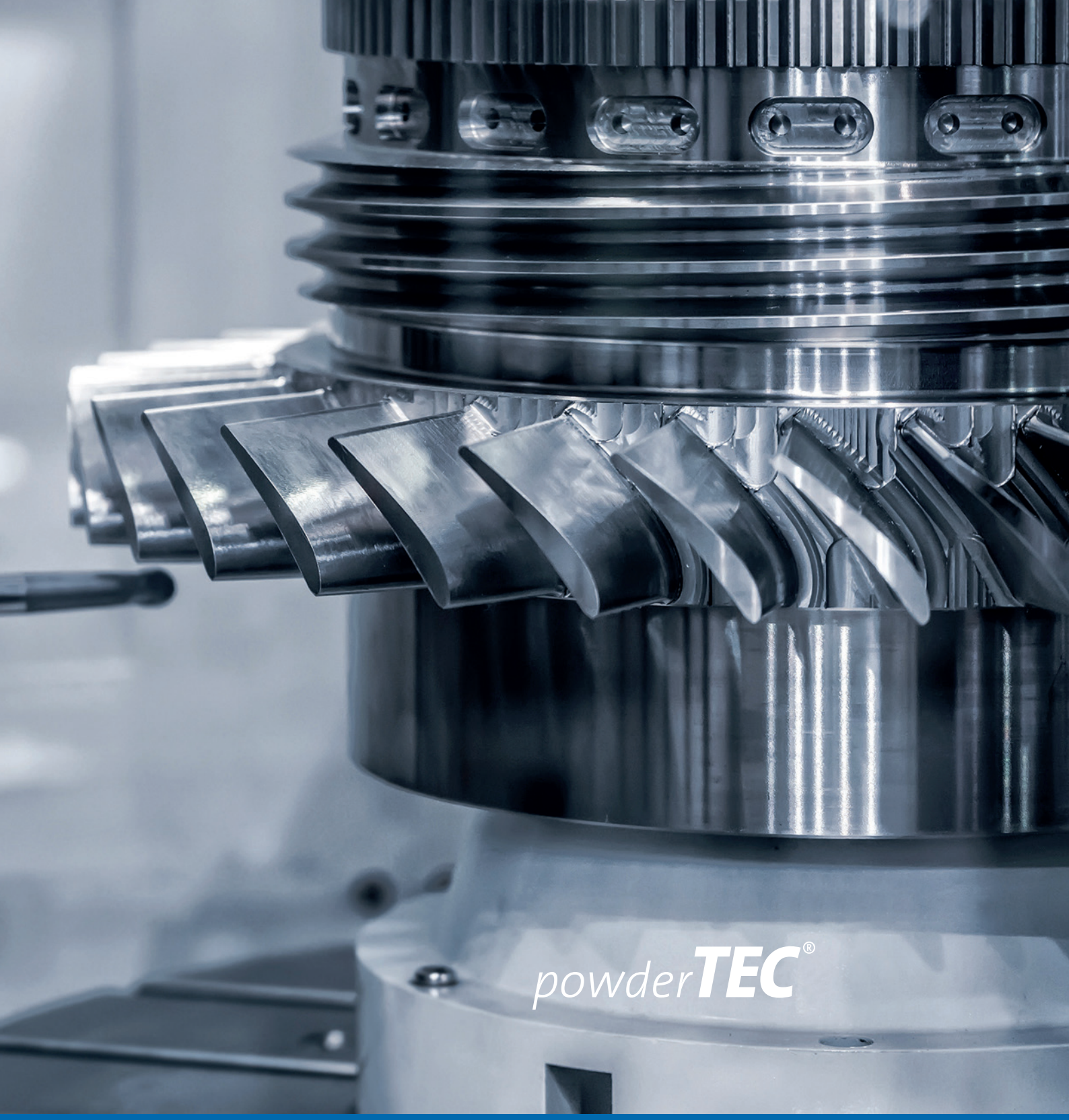
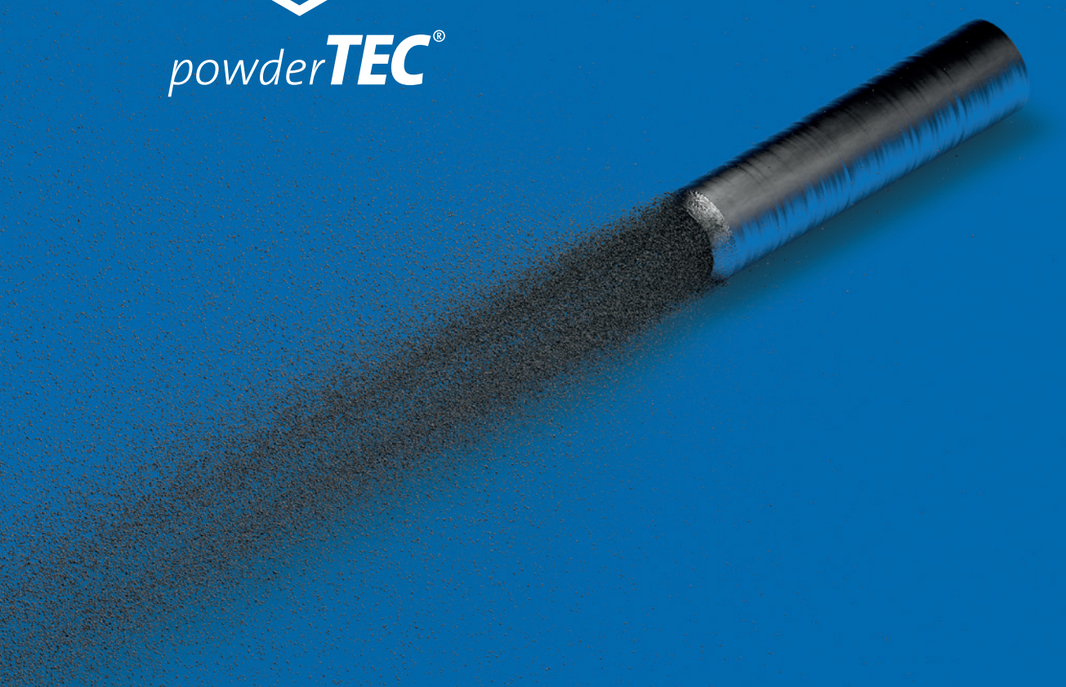


OB-PM-S59
HIGH SPEED STEEL

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

powderTEC®



4TH-GENERATION POWDER-METALLURGICAL STEEL

OB-PM-S59 is a cobalt-alloyed high-speed steel produced by means of a powder metallurgical process which has a very fine, uniform, segregation-free microstructure and carbide distribution. It possesses good wear resistance, good hot hardness, good compressive strength and good toughness. OB-PM-S59 is very suitable for nitriding and its homogeneous microstructure also makes it ideal for PVD and CVD coating.

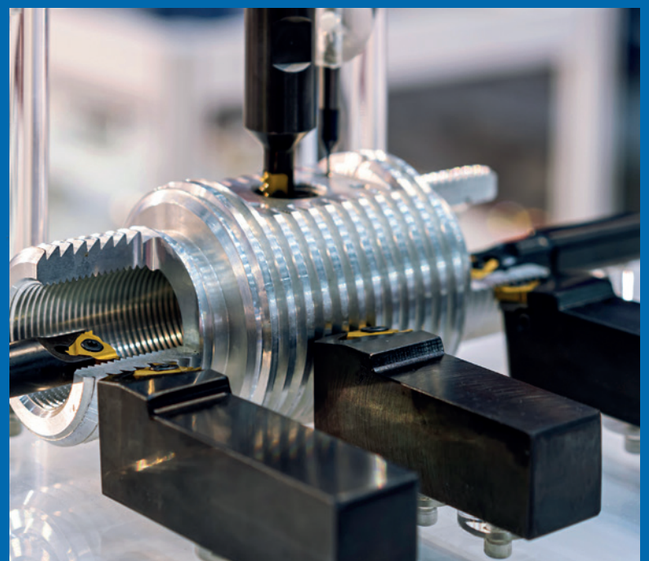
ADVANTAGES AND BENEFITS

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

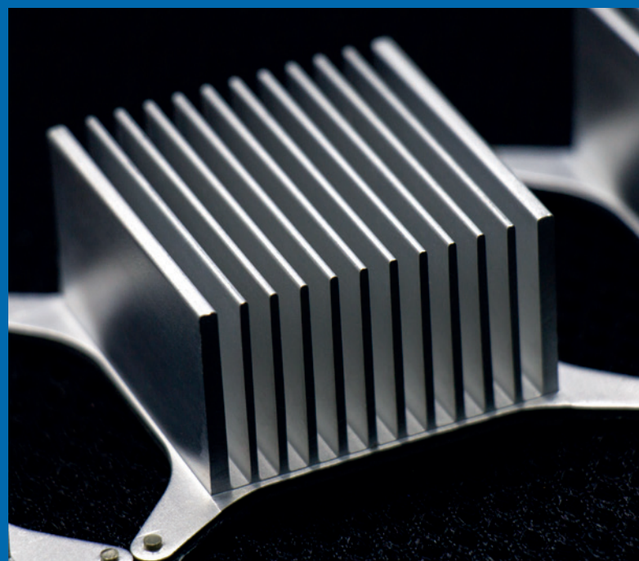
Product merits:
- Very good workability
- Excellent grindability

Top: Good hot hardness and high compressive strength provide machining tools of the highest standard.

Bottom left: Powder-metallurgical high-speed steel OB-PM-S59 offers very good workability.



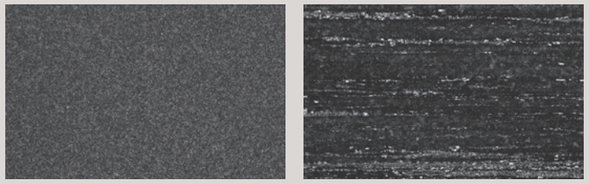
Bottom right: Tools made of OB-PM-S59 enable maximum-precision machining.



APPLICATIONS

OB-PM-S59 is particularly suitable for high-performance machining tools such as stamping, punching, blanking, cutting and forming tools (heavy-duty hob cutters, broaches, generating cutters, punches, dies etc.). Other applications include machining tools for titanium- or nickel-based alloys.

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-S59		1.28	0.50	0.40	4.20	5.00	6.30	3.00	8.40		300	63–68

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

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 ...)	–	10.3	10.5	10.8	–	11.0	11.6	11.9	12.1
Thermal conductivity (W/m * K)	Annealed		19.9	21.7	23.7	24.7	–	25.8	26.6	28.0	29.8

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	1050–1200		Hardening can be carried out under vacuum, in salt bath or in a furnace with a controlled (neutral) atmosphere.
Pre-heating stage 1 Pre-heating stage 2 Pre-heating stage 3	450–550 850–900 1050*		* Essential when high austenitizing temperatures are involved.
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.

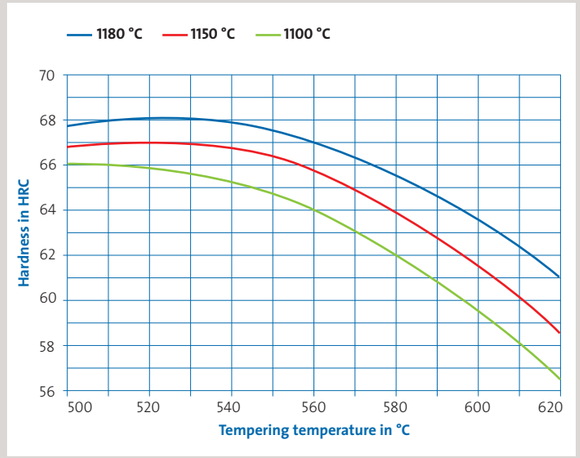
TEMPERING

HARDNESS (HRC) AFTER TEMPERING							
	500 °C	520 °C	540 °C	560 °C	580 °C	600 °C	620 °C
1180 °C	67.5	68.0	67.5	**67.0**	65.5	63.5	61.0
1150 °C	67.0	67.0	66.5	**65.5**	64.0	61.5	58.5
1100 °C	66.0	65.5	65.5	**64.0**	62.0	59.5	56.5

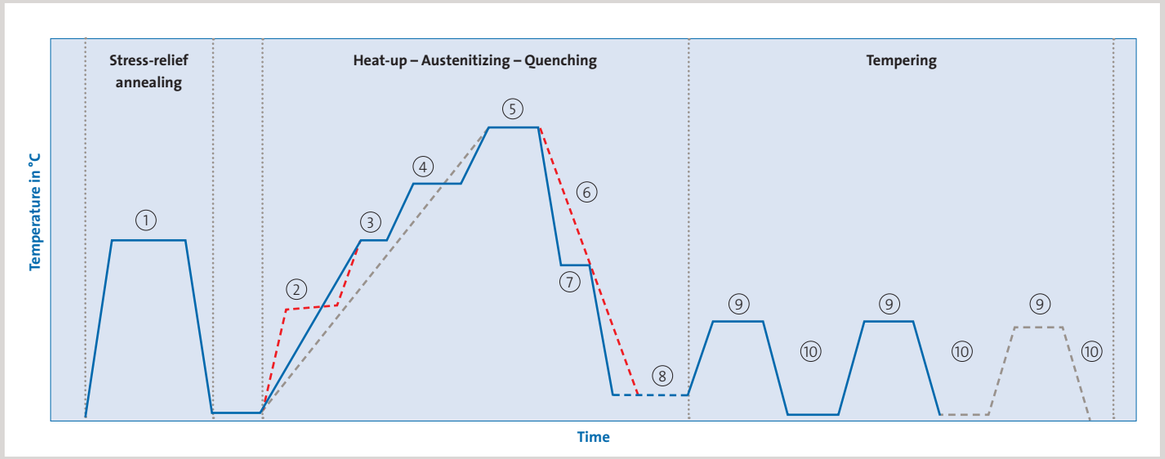
The tempering diagram shows hardness values at different austenitizing and tempering temperatures.

Notes on tempering

- 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 °C to ensure transformation of residual austenite



TEMPERATURE TIMELINE (HEAT TREATMENT)

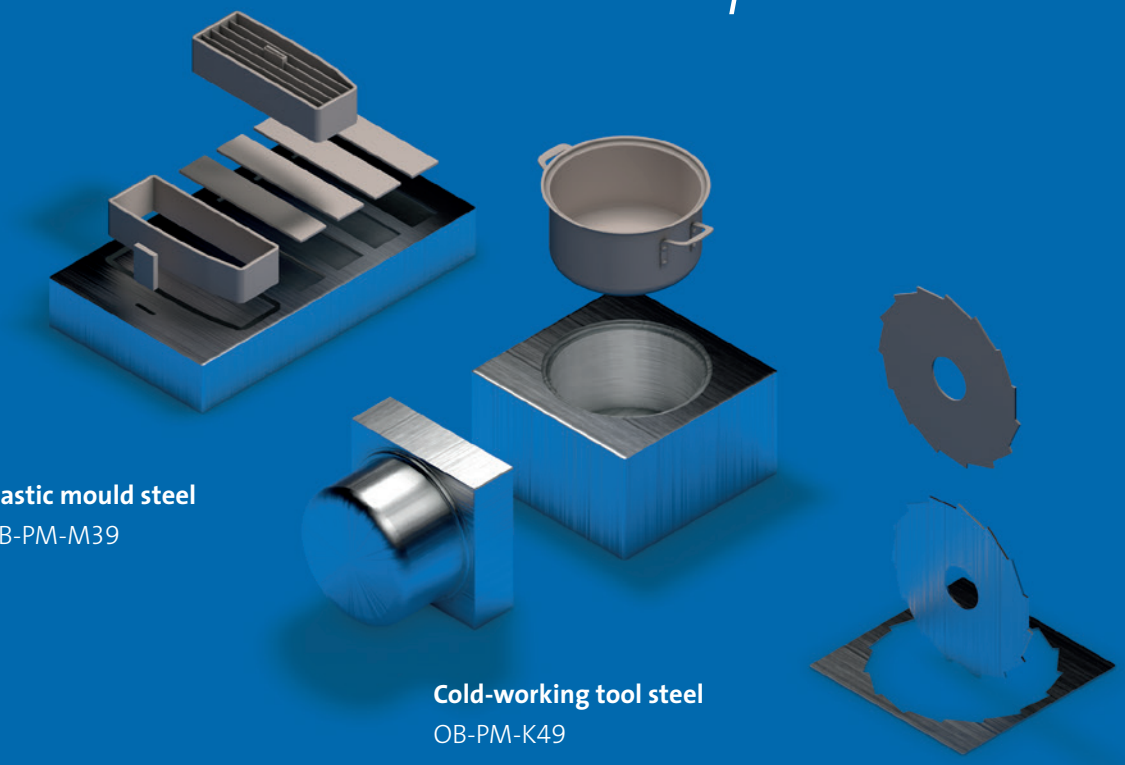


Hardening under vacuum conditions represents the state of the art

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 approx. 1050–1200 °C
6 = Cooling medium: Pressure gas (N_2)
7 = Hot bath approx. 550 °C (graduated quenching)
8 = Holding temperature approx. 50 °C (1 h/100 mm)
9 = Tempering temperature: normally 560 °C
10 = Cooling medium: Air

THE OBERSTE-BEULMANN *powderTEC*® RANGE:

*powder***TEC**®



Plastic mould steel
OB-PM-M39

Cold-working tool steel
OB-PM-K49

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

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