BÖHLER

BÖHLER
M90INTERMET

PRODUCED VIA MICROCLEAN TECHNOLOGY

voestalpine BÖHLER Edelstahl GmbH & Co KG
www.voestalpine.com/bohler-edelstahl

voestalpine
ONE STEP AHEAD.

THE RECORD HOLDER:
50% FASTER
35% MORE DURABLE

BÖHLER
MC90 INTERMET

POWDER
METALLURGY

BÖHLER MC90 INTERMET is a unique cutting material

with a special alloy composition that cannot be categorized in any comparable material group.

Its high-temperature wear resistance is extremely high, making 50% faster cutting speeds a reality.

Combined with at least 35% greater durability

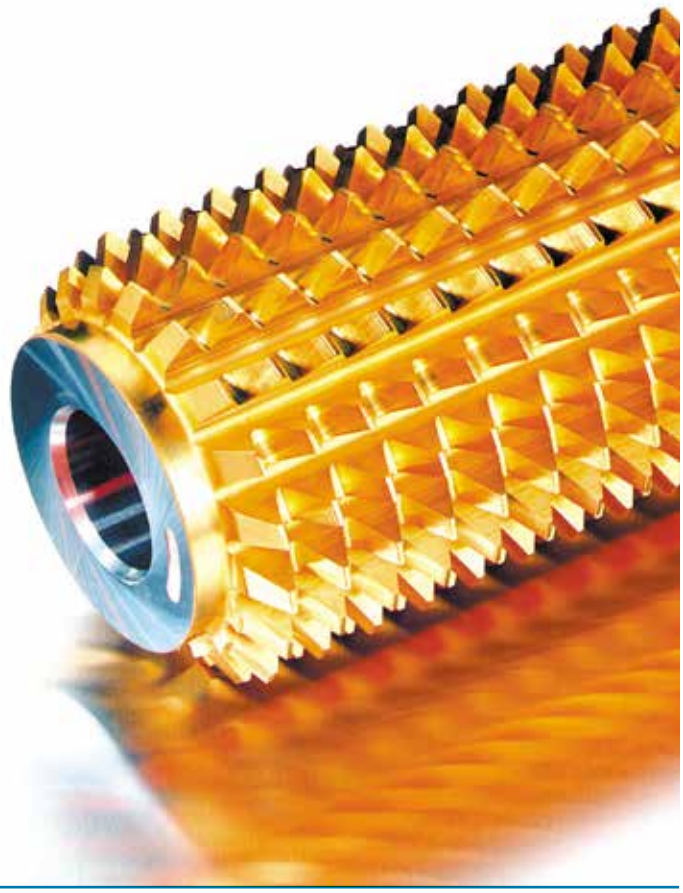
in comparison with classical powder-metallurgical high-speed steels,

BÖHLER MC90 INTERMET increases productivity by up to 70%.

BÖHLER Edelstahl MICROCLEAN® technology brings you up to speed with our powder metallurgical produced new cutting material, BÖHLER MC90 INTERMET, we follow the industry's call for a material providing a balanced spectrum of properties, such as hot hardness, wear resistance, toughness and thermal conductivity. Teaming up with secured availability, good workability and reliability during machining, we offer a material that allows our customers a clean technological and economic advantage.
With decades of experience in highspeed steels, unreached technological expertise and a powder metallurgical process being without equal, the team of voestalpine BÖHLER Edelstahl created an answer to enhanced industry needs:

BÖHLER
MC90 INTERMET

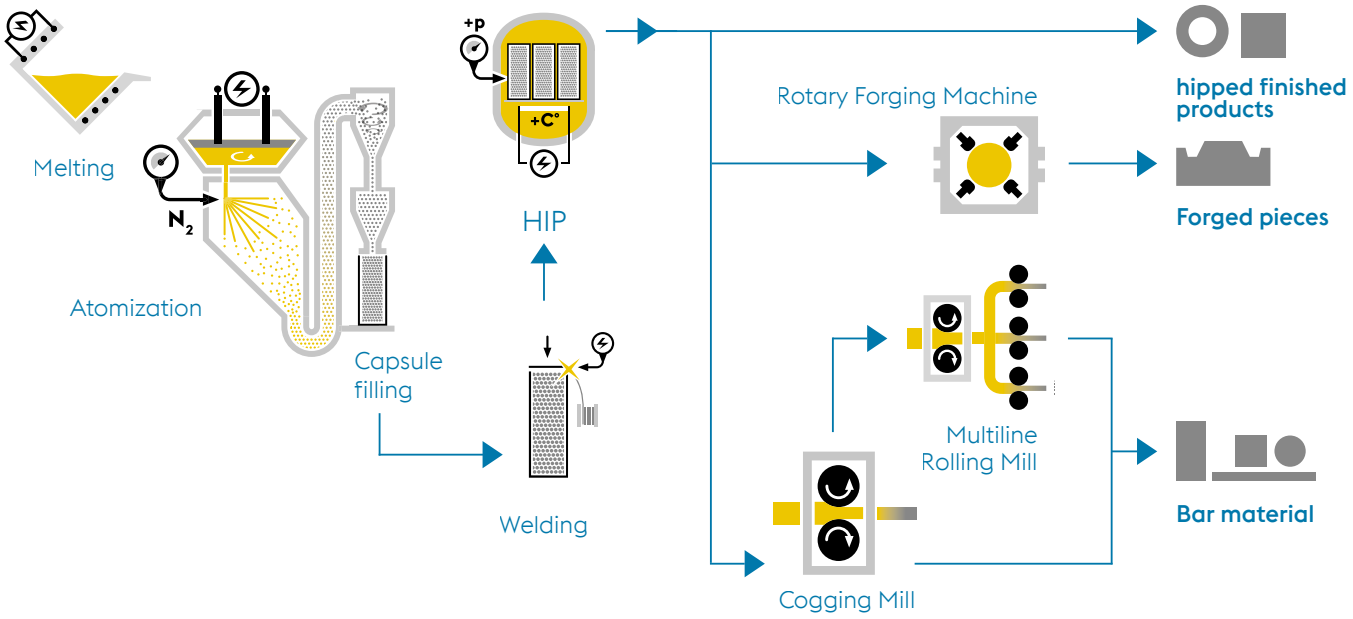
However, as world's best athletes effect performance only with the right equipment, BÖHLER's top athlete MC90 INTERMET requires an adequate coating to reach it's full potential.



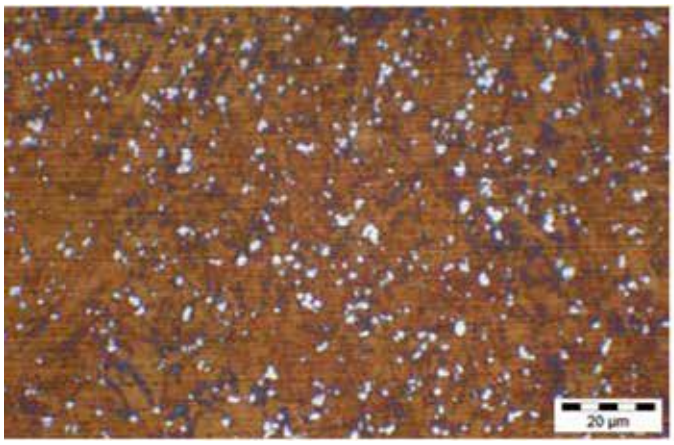
FLOW CHART

BÖHLER
MC90 INTERMET

Can only be produced via 3rd generation PM process



BÖHLER
MC90 INTERMET



Intermetallic phases (white) which are embedded in a precipitation hardened matrix.

HS PM30

Primary carbides (white) which are embedded in a tempered high speed steel matrix.

HEAT TREATMENT

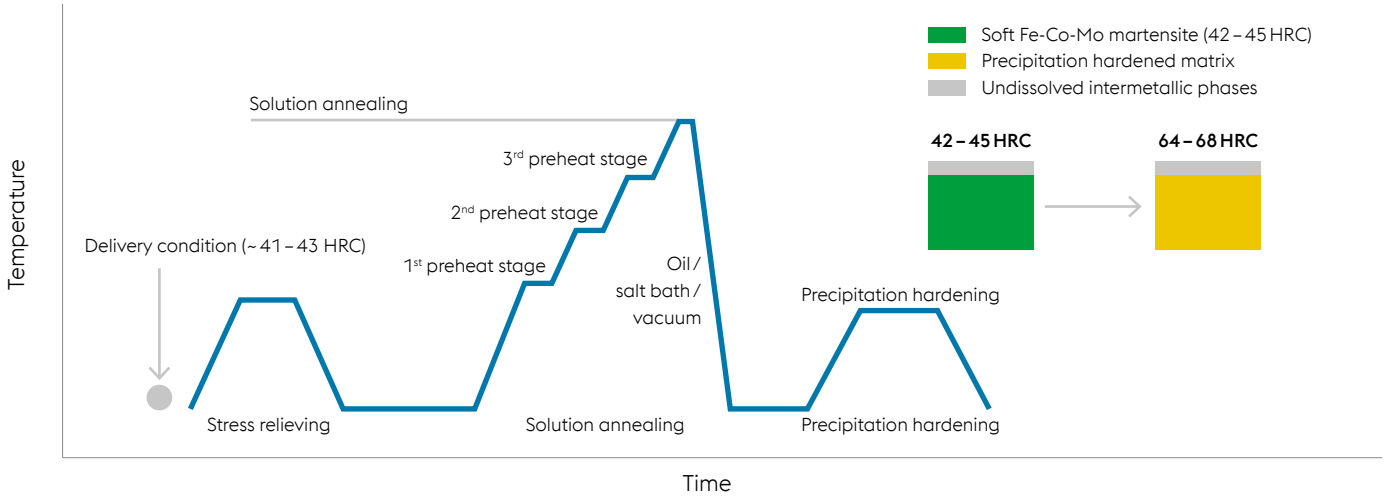
» Achievable hardness according to type and application of the tool in use 65 – 68 HRC.

» Solution annealing ranging from 1180 to1190 °C (2156 to 2174 °F), using normal preheating and holding times for high speed steels.

» Then quench in an oil or nitrogen atmosphere.

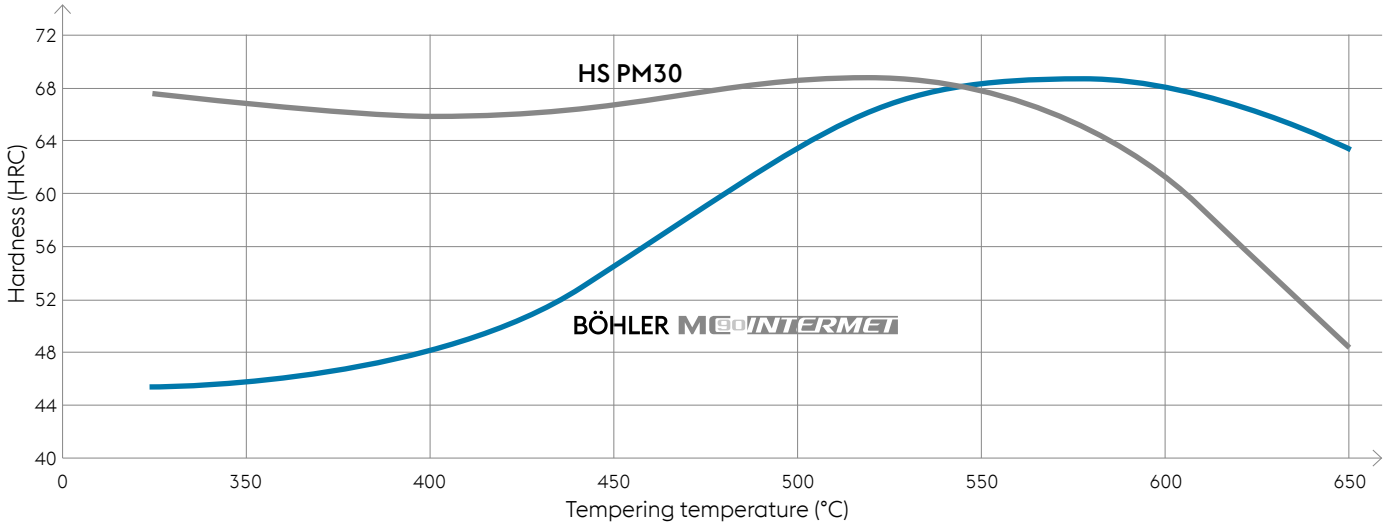
» Precipitation hardening 590 and 630 °C (1094 and 1166 °F) for 3 hours (1 x 3 h) to achieve a hardness of 65 – 68 HRC.

Heat treatment sequence



Remark:
Due to the alloying concept of BÖHLER MC90 INTERMET are the correct terms for the heat treatment "solution annealing" and **"precipitation hardening" instead of "hardening" and "tempering".**

Hardening curve

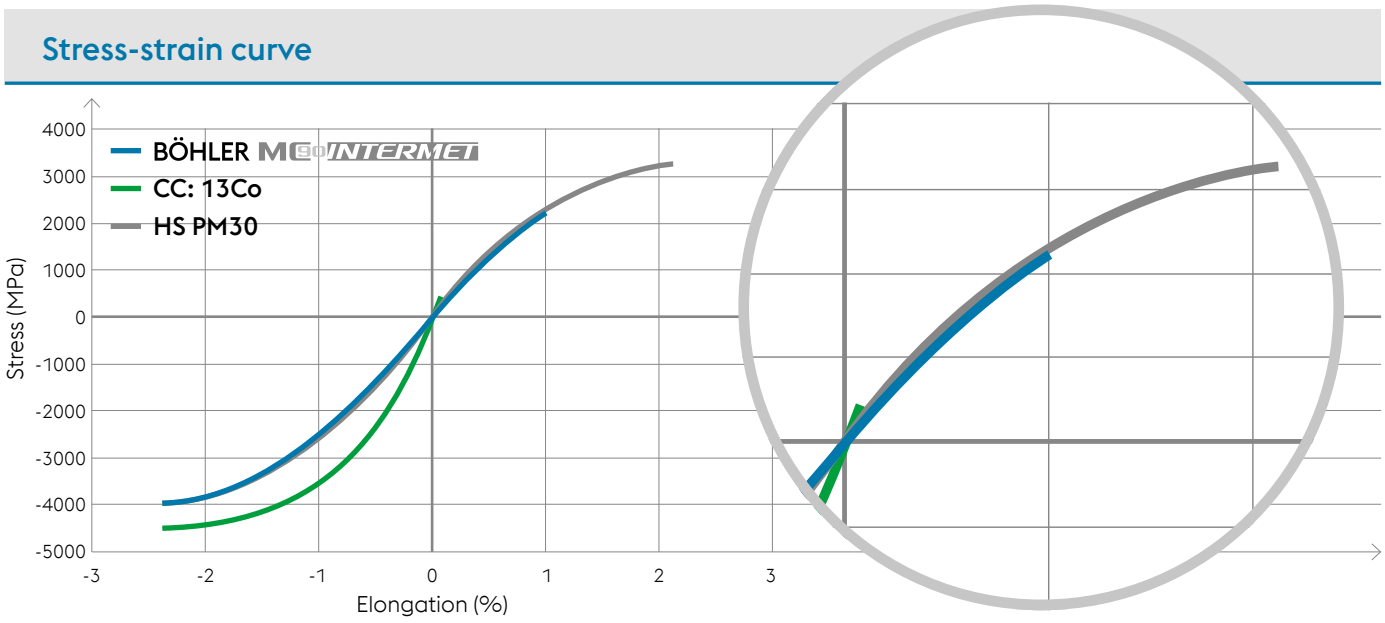


Specimen size: round 30 mm, 20 mm thickness
Solution annealing: Vacuum furnace, 1190 °C, 3 minutes soaking time, Quenching 10 bar N_2
Precipitation hardening: 1 x 3 hours

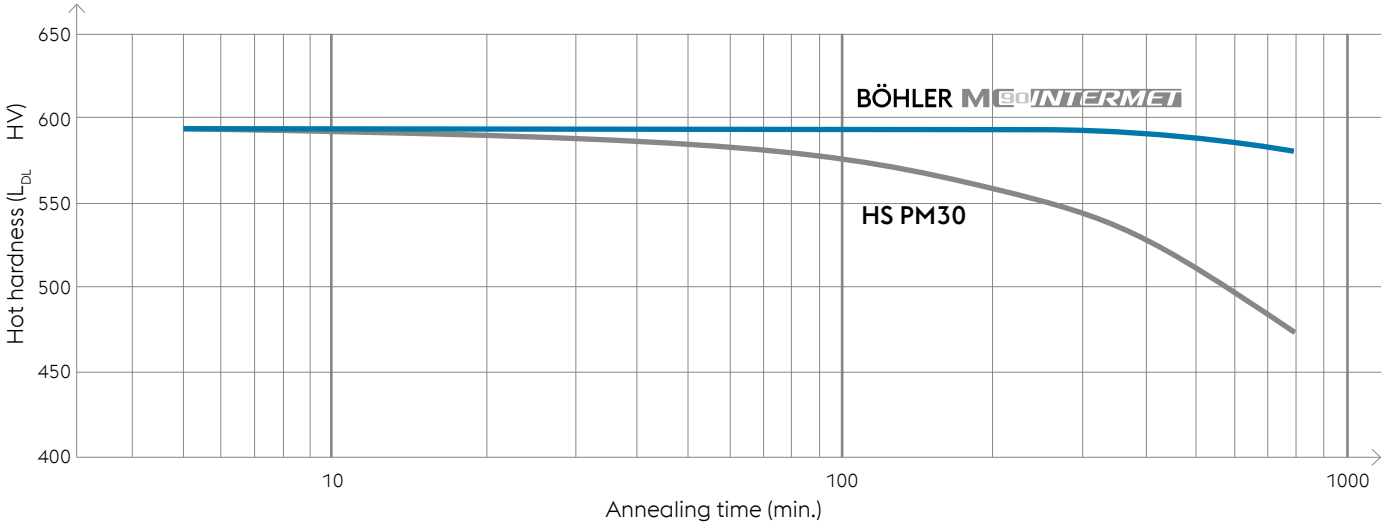
MAJOR PROPERTIES

Stress-strain curve of **BÖHLER MC90 Intermet** under tensile and compressive loading in comparison with the high speed steel grade PM30 and cemented carbide.

Stress-strain curve



Thermal stability



T = 600 °C (1112 °F) = constant

This is the reason why **BÖHLER MC90 Intermet** excels with a high thermal stability at appealing ductility and toughness levels.

NUMBERS, FACTS AND DATA

Thermal expansion between 20 °C and ... °C

20 °C	100 °C	200 °C	300 °C	400 °C	500 °C	600 °C	700 °C	
–	9.92	10.10	10.44	10.73	11.06	11.32	11.51	10^{-6} m/(m.K)

Heat capacity

20 °C	100 °C	200 °C	300 °C	400 °C	500 °C	600 °C	700 °C	
0.386	0.440	0.463	0.485	0.509	0.537	0.589	0.643	J/(g*K)

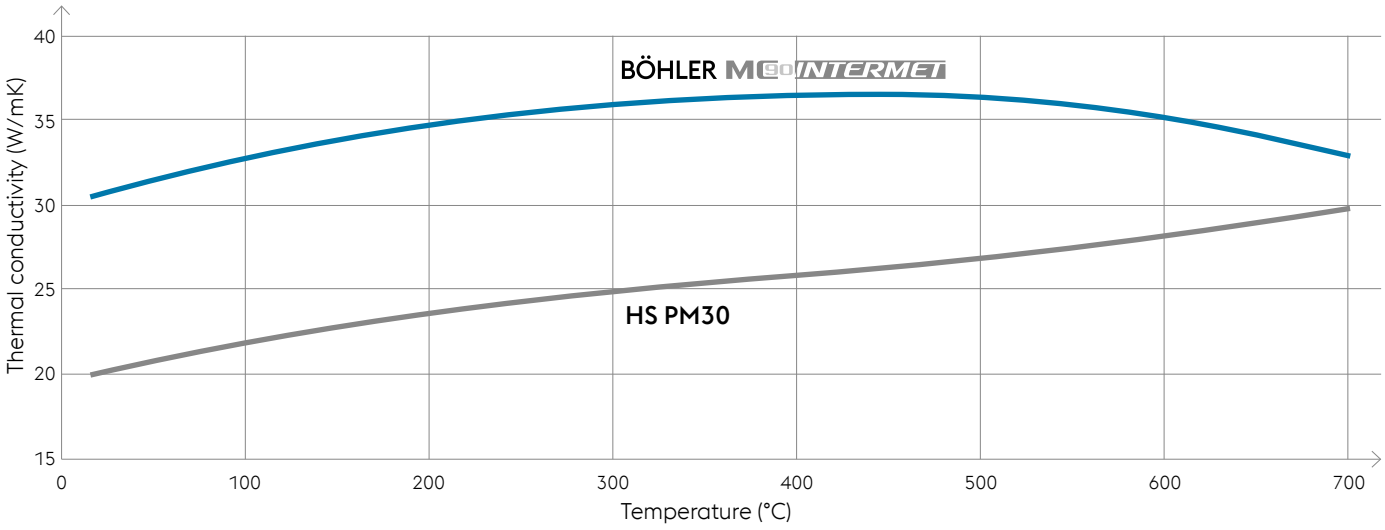
Density

20 °C	100 °C	200 °C	300 °C	400 °C	500 °C	600 °C	700 °C	
8276	8257	8232	8204	8176	8145	8113	8084	kg/m³

Modulus of elasticity

20 °C	100 °C	200 °C	300 °C	400 °C	500 °C	600 °C	700 °C	
223.3	218.8	213.8	207.1	198.6	192.4	182.1	163.2	10^3 MPa

Thermal conductivity



The new cutting material's very high thermal conductivity reduces any effective thermal loading in operation.

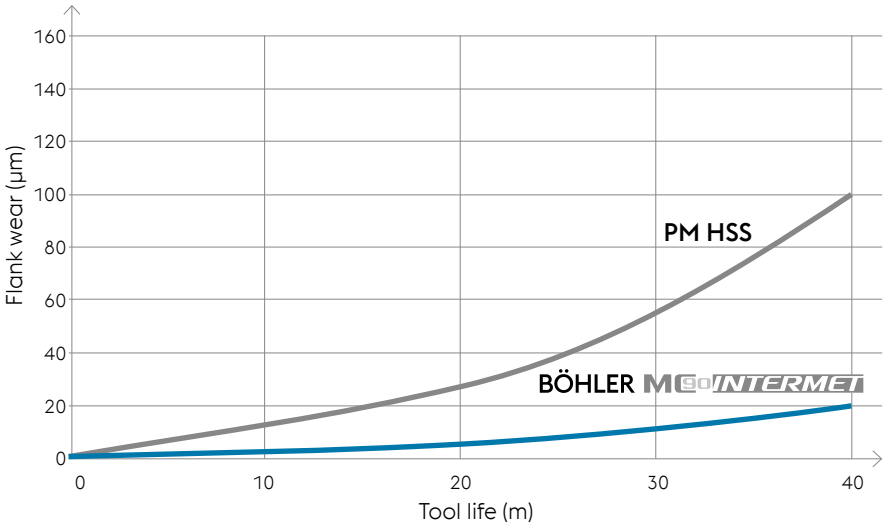
TOOL LIFE COMPARISON

MILLING OF TIAl6V4

Form milling of turbine blade bar steel
Tool life was doubled at the first go when **BÖHLER MC90 Intermet** was used in the milling of turbine blade bar steel.

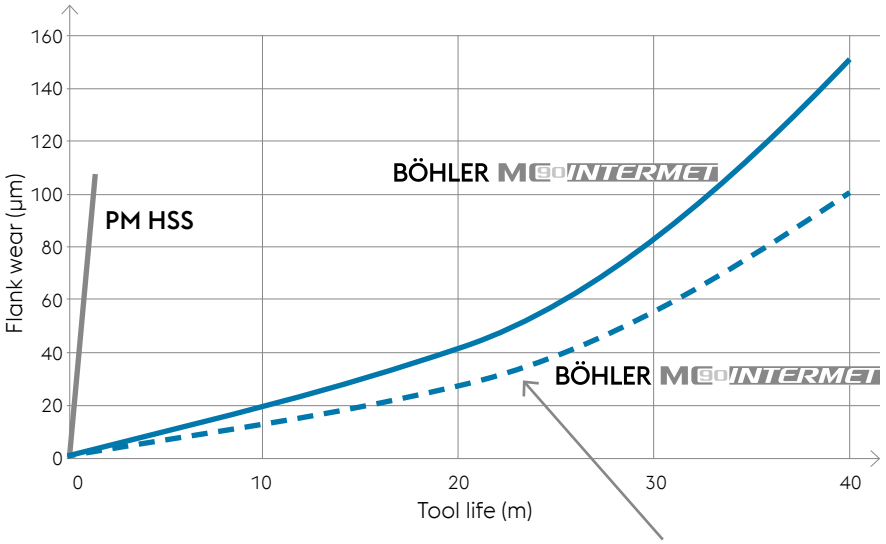
BÖHLER MC90 Intermet is a new cutting material, primarily excelling with its high temperature stability and high thermal conductivity.
With these properties, the new cutting material is particularly suited for use in machining tools where high temperatures, stresses and strains due to temperature changes play a major role. A case in point is the machining of titanium alloys, Ni-based materials, austenitic steels or stainless steels. Due to the lack of carbon in the steel, no retained austenite is present after heat treatment. This is why a repeated tempering is not required, decreasing heat treatment costs and process times.

Tool life comparison



v_c = 40 m/min, f_z = 0.4 mm, a_p = 6 mm, a_e = 3 mm

Tool life comparison



f_z = 0.1 mm, a_p = 6 mm, a_e = 3 mm

- **BÖHLER MC90 INTERMET** v_c = 120 m/min
- **BÖHLER MC90 INTERMET** v_c = 80 m/min
- **PM HSS** v_c = 120 m/min

It must be emphasized here that **tool geometries** have to be adjusted or at least reconsidered with a view to the changed properties of **BÖHLER MC90 Intermet**.

SECURE YOUR ADVANTAGE:

» Up to 70% increase in productivity

» Process reliability similar to PM HSS

» Worldwide processing to manufacturer's quality standards

Economic advantages over classical PM HSS:

» Higher thermal stability of the substrate in comparison with classical PM HSS

» Making significantly higher cutting speeds feasible

Advantages for handling:

» Finish grinding and coating similar to PM HSS

» Simplier heat treatment, similar to precipitation hardened steels with single solution annealing and precipitation hardening

Advantages over cemented carbide:

» Lower risk of fracture

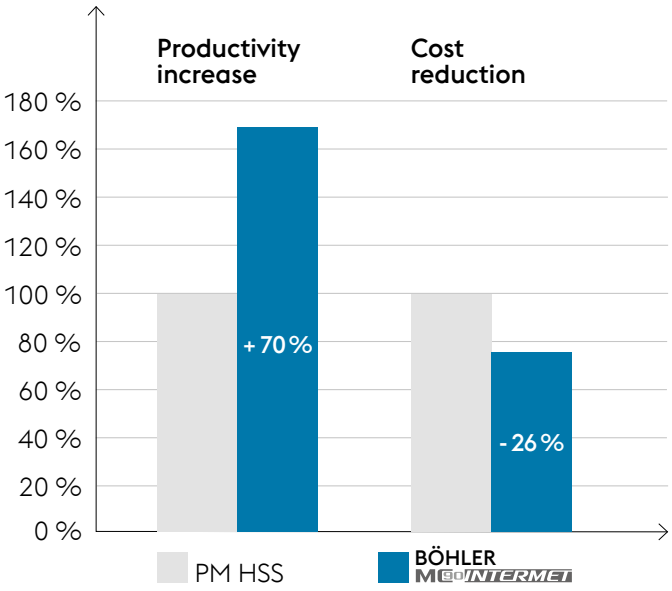
» Easier preparation of tools, no cobalt washout when removing coating

» Better damping behavior for vibration-prone components

» Lower weight (for easy handling)

Application examples from the automotive industry

Milling gears for a passenger car transmission
Modulus: 2,15, Material: 20MnCr5
Annual quantity: 500,000 parts



	Compression strength	Tensile strength	Toughness	Thermal stability	Resistance to temperature changes	Thermal conductivity	Heat treatment	Flexible machinability
BÖHLER MC90 INTERMET	~	+	+	+	++	+	++	++
PM HSS	~	++	++	-	++	-	+	+
Cemented carbidel	++	--	--	++	--	++	/	--

ABOUT THE AUTHORS:

voestalpine BÖHLER Edelstahl is worldwide one of the leading Special Steel and Special materials supplier. We develop, produce and deliver high speed steels, tool steels and special materials worldwide, to provide our customers with exemplary solutions.

BERNHARD WINTER

MANAGEMENT: HIGH SPEED STEEL & AUTOMOTIVE COMPONENTS

Bernhard Winter started his career 2001 in the sales department for High Speed Steels at voestalpine BÖHLER Edelstahl. He is leading this department since October 2015 and since 1st of April 2020 he is also the responsible sales manager for all BÖHLER grades sold in the Automotive Industry as components.
He was part of the initial R&D project that led to the market launch of MC90 INTERMET and therefore understands the advantages of this specific cutting material.
MC90 INTERMET is a unique solution that provides properties that where never possible for a PM High Speed Steel. What makes this grade so innovative is that only the combination of special steel and coating results in the outstanding performance of MC90 INTERMET.

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PATRICK HÖDL

PRODUCT MANAGEMENT HIGH SPEED STEEL

Patrick Hödl started his career 2008 in the sales department at voestalpine BÖHLER Edelstahl being responsible for special steels for power generation and engineering applications.
After taking care of Oil & Gas products such as Nickel base alloys and Austenitic steels from 2014 onwards, he took over the product management for High Speed Steels in 2020 where our PM produced grades including MC90 INTERMET are one of his main priorities. His focus segments are Gear cutting, reaming, broaching and High Speed Steels in Cold Work applications.

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BARBARA STARZER

TECHNOLOGY TOOLING

Barbara Starzer completed her studies in materials science at the Montanuniversity Leoben, followed by a doctorate. After 5 years at Pankl Racing Systems in R&D she started her career 2006 as application engineer for tool steel & high speed steel at voestalpine BÖHLER Edelstahl.
From 2010 she is working in the area Technology Tooling, until 2015 as responsible technician for high speed steel, with the main focus on application engineering in cutting applications. Since 2015 her focus is on application engineering of high speed steel (incl. MC90 INTERMET) and tool steel for cutting, non tooling and automotive applications.

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