KMSi

KUSHAL METAL & STEEL INDUSTRIES PVT. LTD.

A LEGACY FORGED IN STEEL SINCE 1968

TPM

NITRION 20

Stainless PM steel for both good wear resistance and excellent corrosion resistance associated with high fatigue resistance

TPM NITRION 20 is a nitrogen alloyed tool steel obtained by powder metallurgy. It is characterized by very good wear resistance associated with excellent corrosion resistance and high hardness associated with a high fatigue resistance.

Applications

TPM NITRION 20 is used in high-performance bearings, medical devices, and high-end cutting tools.

TPM NITRION 20 is particularly recommended for tools where high hardness and wear resistance associated with excellent corrosion resistance is required.

TPM NITRION 20 can also be used in molds for glassware.

TPM NITRION 20 is suitable for food and medical applications.

Main properties

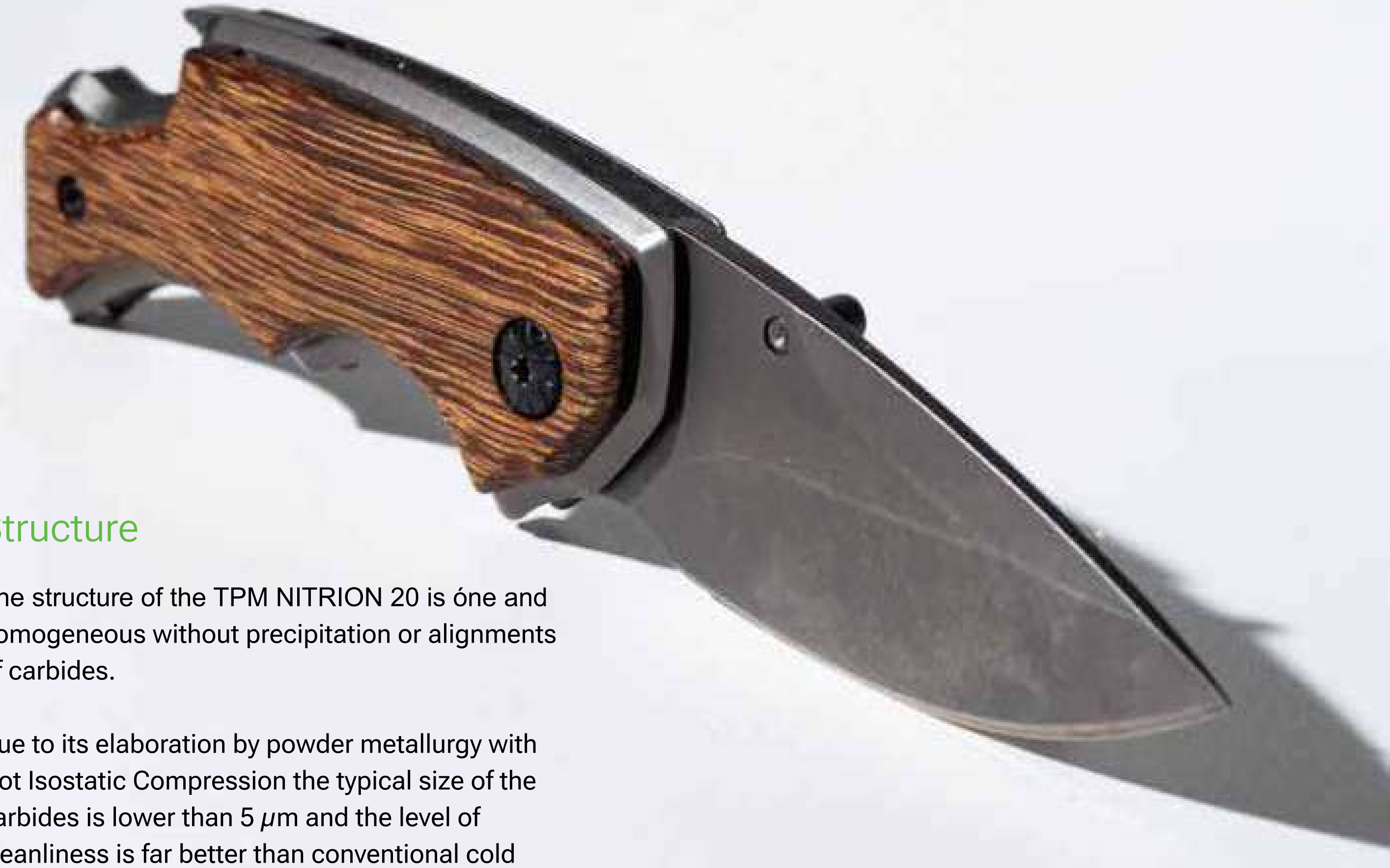
- Excellent corrosion resistance
- Good wear resistance
- High hardness
- Good compressive strength
- High fatigue resistance
- Very good strength

Chemical composition *(typical)*

C	Si	Mn	Cr	Mo	V	Ni	N
0.40	0.50	0.40	15.5	1.70	0.3	0.50	0.20

Designation

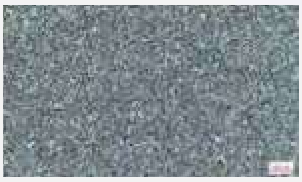
Werkstoü Nr	ISO	China GB	JIS Japan	UK	AISI USA	Russia Gost	AFNOR	Other / Special
1.4123	X40CrMoVN16 2	-	-	-	UNS S42025	-	-	-



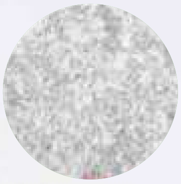
Structure

The structure of the TPM NITRION 20 is óne and homogeneous without precipitation or alignments of carbides.

Due to its elaboration by powder metallurgy with Hot Isostatic Compression the typical size of the carbides is lower than 5 μm and the level of cleanliness is far better than conventional cold work tool steels.



HOMOGENEITY OF EUTECTIC CARBIDE: LEVEL 0



LARGE GRAIN CARBIDE SIZE: χ 4.8 ɲm

Corrosion resistance

As shown in the pictures below, the corrosion resistance is signiócantly better when compared to standard stainless steels X105CrMo17 *(440C)* and 17 - 4 PH.

TPM NITRION 20 was tested by salt spray test *(480 h salt spray (NaCl) exposure.)* after the following heat treatment:

Austenitization: 1050°C/
Tempering:
Hardness: 59.2 HRC

TPMNITRION 20

17 4 PH

X105CrMo17 (440C)

Hardness at the time of delivery

Annealed for 250 HB max.

Typical mechanical properties in hardened conditions *(results from internal tests not indicated on the certiócates)*

TS MPa	YS 0.2% MPa	Hardness HRC	KV J 20°C
2150	1602	56.5	20
2210	1743	59.2	10.4
2320	1854	59.5	5.4

Physical properties

Temperature	20°C
Volumic mass kg/m^3	7700
Young Modulus N/mm^2	195000
Thermal conductivity W/m.K	25
Coeωcient of linear expansion 10^{-6}/K	10.5

Heat treatment

SOFT ANNEALING

Temperature: 850 - 870éC, duration 1h + 1h for 25 mm thickness. Slow cooling in the furnace *(10 to 20°C / h).*

STRESS RELIEVING

After machining, it is recommended to perform stress relieving at 650°C for a minimum of 2 hours, followed by slow cooling in the furnace to 450°C.

AUSTENITIZATION

In order to avoid any risk of cracking it is recommended to preheat in 2 steps.

- 1st preheating step:
  temperature: 500°C time: 30 s/mm of thickness
- 2nd preheating step:
  temperature: 875éC time: 30 s/mm of thickness

Recommended austenitizing temperature: 1010 - 1080éC. The holding time should not be too long to avoid a risk of grain coarsening and a loss of toughness. It is recommended to keep the part at the austenitizing temperature 30 minutes per inch of thickness as soon as the temperature of the surface reach the austenitization temperature.

QUENCHING MEDIUM

Oil at 80éC, vacuum *(pressure > 6 bars)*, salt bath 500 - 550°C.
To ensure good toughness, treatment with oil or salt bath is preferable.

SUB ZERO TREATMENT

For parts that need to have high dimensional stability and to increase wear resistance without reducing toughness, it is recommended to perform a subzero treatment at a temperature between -70°C and -120°C for 1 hour for 25 mm of thickness of the part.

The temperature range from -70°C up to -120°C *(named cold treatment of steel)* leads to the complete transformation of austenite into martensite and as a consequence to better stability associated with improved hardness and better wear resistance.

This treatment is optional for common applications.

TEMPERING

To ensure a minimum residual austenite rate as well as greater tool stability, it is essential to perform double *(better triple)* tempering. Each tempering is followed by a cooling under 100°C. For optimal corrosion resistance avoid to perform the tempering in the temperature range of 400 to 550°C.

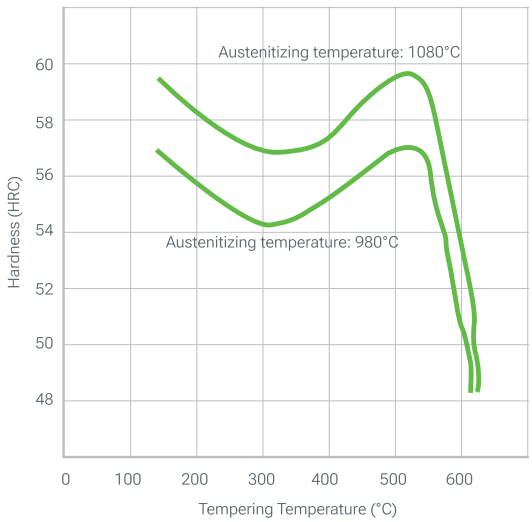
Depending on the use of the ónal part the following tempering temperatures are recommended:

Austenitizing temperature	Tempering temperature	Hardness	Properties
1050°C *	180éC	59 HRC	Optimized hardness and corrosion resistance
1010°C	180éC	56.5 HRC	Good corrosion resistance and good toughness
1075°C*	500°C	59.5 HRC	For tools working at high temperature with high hardness and moderate corrosion resistance.

** Subzero treatment is recommended to lower the retained austenite content.*

Each tempering time must be at least equal to 1h + 1h for 25 mm of thickness of the treated part *(equivalent thermal thickness)*.

TEMPERING CURVE



Surface treatment

NITRIDING

TPM NITRION 20 is a stainless steel and cannot be nitrided.

PVD, CVD

TPM NITRION 20 is suitable for all kind of PVD and CVD treatment as soon as the treatment temperature is 30°C lower than the last tempering temperature.

SURFACE HARDENING

TPM NITRION 20 is suitable for surface hardening by induction or laser.

It is recommended to do the heat treatment of the "bulk" tool with an austenitization temperature of 1050°C and a double tempering at 650°C to reach a "bulk" hardness of 35 - 37 HRC. After surface hardening by induction or laser the surface hardness will be at 55 - 58 HRC on a depth of 2 mm for induction hardening and 1 mm for laser hardening. After hardening a stress relieving at 150°C for 2 h minimum is mandatory.

Machining

The machining parameters below are given for information only and must be adapted according to the equipment and usual machining conditions.

TURNING IN ANNEALED CONDITIONS

	Carbide tool	
	Rough machining	Finishing
Cutting speed m/min	60 - 70	70 - 80
Feed mm/r	0.4 - 0.6	0.1 - 0.2
Depth of cut mm	2 - 4	0.3 - 0.5

GRINDING IN ANNEALED CONDITIONS

	Carbide insert	Solid tool
	Rough machining	Finishing
Cutting speed m/min	60 - 70	50 - 90
Feed mm/r	0.15	0.10 - 0.15
Depth of cut mm	2 - 3	0.1

DRILLING IN ANNEALED CONDITIONS: CARBIDE DRILL

	Solid
Cutting speed m/min	40
Feed mm/r	0.15

HSS TWIST DRILL

Drill diameter mm	Cutting speed m/min	Feed mm/r
< 5	7	0.10
5 - 10		0.20
10 - 15		0.30
15 - 20		0.35

FINE GRINDING

General indications for grinding wheels to be used on TPM NITRION 20 in the heat treated condition. Usually, rather soft vitrióed aluminum oxide grinding wheels *(grades G for plane grinding to K for cylindrical grinding)* are used.

Particular attention will be paid to eüective cooling of the surface during grinding to prevent degradation of the material surface.

ELECTRO-DISCHARGE MACHINING

TPM NITRION 20 is also suitable for EDM machining *(wire or electrode)*. Preferably, the machining will be carried out with a low current density and a high frequency in order to limit the thickness of the white layer as much as possible.

Then it is necessary to carry out a stress relieving at 25°C below the last tempering in order to reduce the level of residual stresses (*which could lead to a risk of cracking)* and to carry out a polishing to completely remove the white layer formed during the discharge machining process.

Avoid to perform the stress relieving in the range 400 - 550°C if a good corrosion resistance is required.

OUR PRESENCE

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