RSACCIAI
MADE TO PERFORM

Nicro® 100

PHARMACEUTICAL
MEDICAL
PACKAGING
FOOD
PLASTIC
OFF SHORE

Blades
Filling units
Extrusion units
Pump components
Portioner
Precision measurement tools
Pharmaceutical punches
Shredder knives and granulator
Plasticizing screws
Mirror-polished dies
Surgery instruments

CORROSION
TOUGHNESS
WEAR

NICRO® 100

is a new high nitrogen alloyed tool steel which exhibits superior corrosion resistance combined with high toughness even at hardness up to 60 HRc

It is produced combining PESR-Process (Pressurized Electric Slag Remelting) with a smart forging technology. The combination of these two processes give to the steel an amazing increase in cleanliness and structure, which means a very fine and homogenious microstructure. Primary advantage are excellent machinability and polishability as well as a high dimensional stability after heat treatment.

The use of nitrogen, in partial replacement of carbon, gives a higher resistance to corrosion and wear compared to other stainless steels for cold work produced with conventional methods.

NICRO 100 is the high end solution for tools facing high static and dynamical load under a high corrosive environment at higher temperatures.

Compared to standard tool steels like: 1.2316, 1.2083, 1.4112, 1.4125, 1.4301, 1.4034, 1.2363 e 1.4528, NICRO 100 exhibits higher corrosion resistance and toughness as well as a higher tempering resistance up to 500 °C still at a hardness of 58-60 HRc

_corrosion resistance

_high toughness

_excellent machinability

_dimensional stability after heat treatment

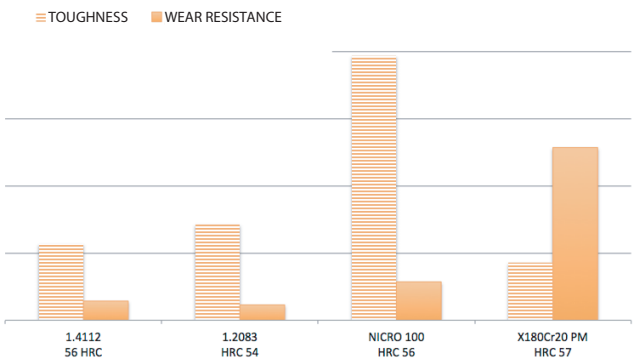
_excellent polishing

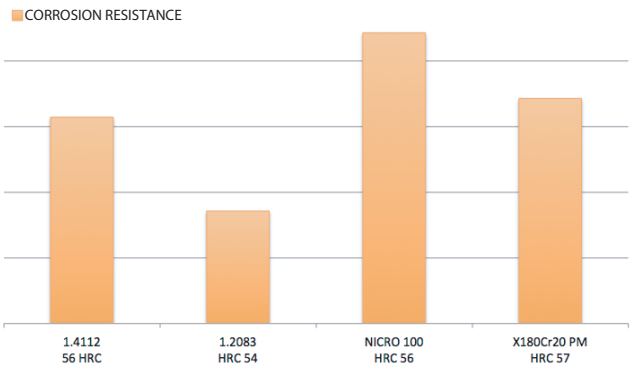
_resistence to static and dynamic stresses

_good wear resistance

_tempering resistance up to 500 ° C

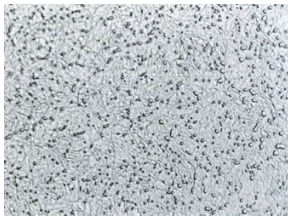
Carbon	0,25 - 0,35	%
Silicon	0 - 1,00	%
Manganese	0 - 1,00	%
Chromium	14,0 - 16,0	%
Nitrogen	0,30 - 0,50	%
Nickel	0 - 0,5	%
Molybdenum	0,85 - 1,10	%



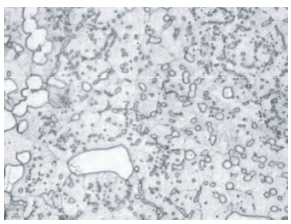


Modulus of Elasticity	214	GPa
Density	7,72	g/cm³
Thermal Conductivity	14	W/m°K

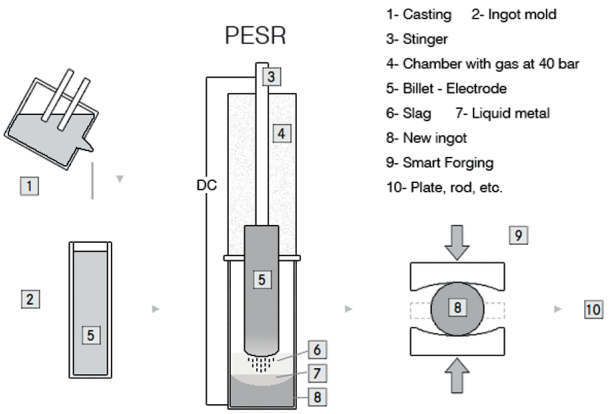
structure (1000x)



NICRO 100



1.4112



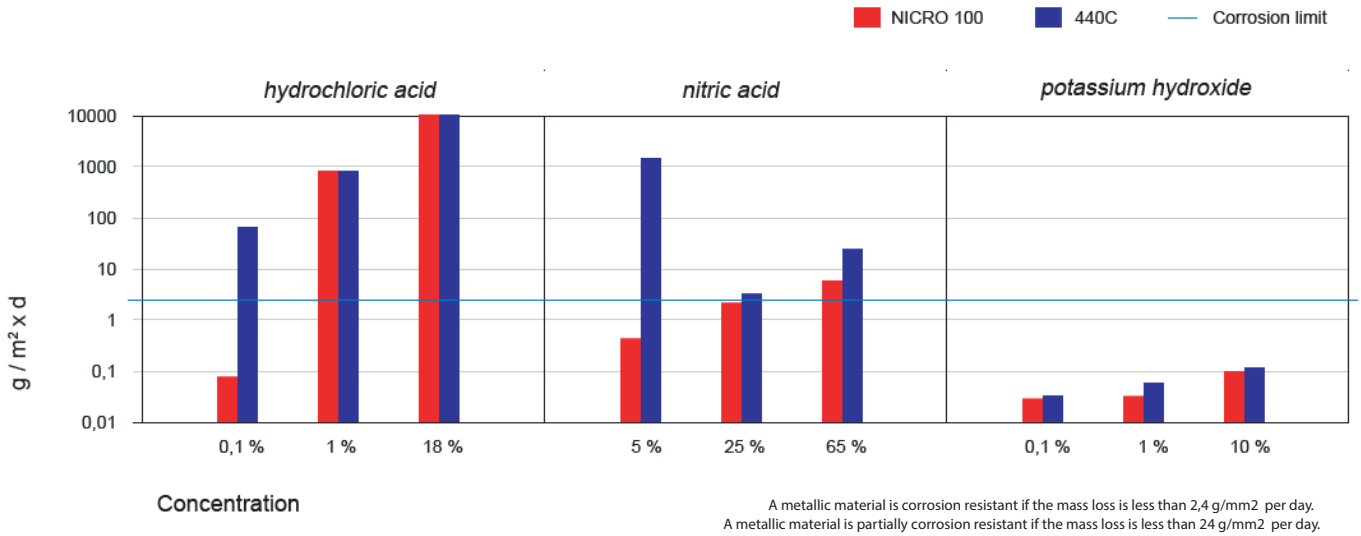
PRODUCTION PROCESS

High nitrogen alloyed matrix tool steels have high mechanical properties and corrosion resistance.
Special processes are required to obtain these proprieties. For this reason, for the steel NICRO 100 a particular remelting system called PESR (Pressure Electro Slag remelting) is used to increase the nitrogen content beyond the solubility limits.
The material is then forged by the use of a hammer optimized in shape, that allowing the forging energy to spread efficiently, even in depth.
The combination of the two processes create high purity steel with a homogeneous and fine grain microstructure.

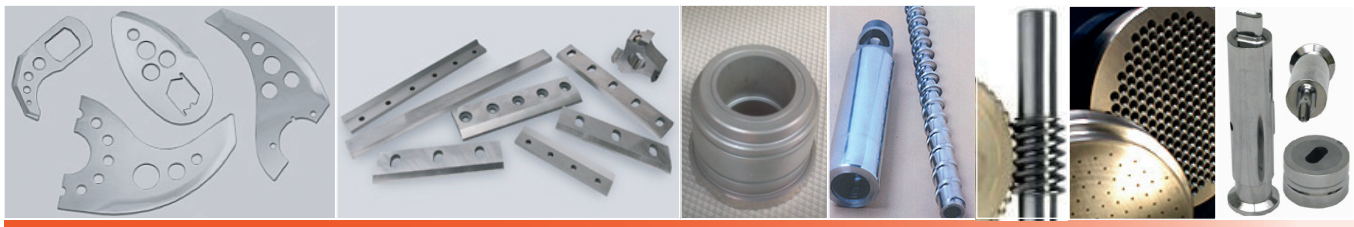
CORROSION RESISTANCE

	conc. %	100Cr6 1.3505	**NICRO 100**	X46Cr13 1.4043	X90CrMoV18 1.4125	X102CrMo17 1.4125	AISI 440C
Seawater	4,0	- -	+ +		+ +	-	-
Hydrochloric acid (HCl)	0,1	- -	+ +	- -	-	- -	- -
Sulfuric acid (H_2SO_4)	10,0	- -	- -	- -	- -	- -	- -
Nitric Acid (HNO_3)	5,0	- -	+ +	+ +	+ +	- -	- -
Phosphoric acid (H_3PO_4)	10,0	- -	+ +	-	+	+	+
Citric acid ($C_6H_8O_7$)	25,0	- -	+ +	-	+	- -	- -
Sulphurous acid (H_5SO_4)	1,0	- -	+ +	- -	-	- -	- -

++ constant / + fairly constant / - barely applicable / - - unstable / untested



A metallic material is corrosion resistant if the mass loss is less than 2,4 g/mm2 per day.
A metallic material is partially corrosion resistant if the mass loss is less than 24 g/mm2 per day.
[Dechema-Werkstoff-Tabelle, Korrosions und chemische Beständigkeit von Werkstoffen, E41, November 1999]



HEAT TREATMENT

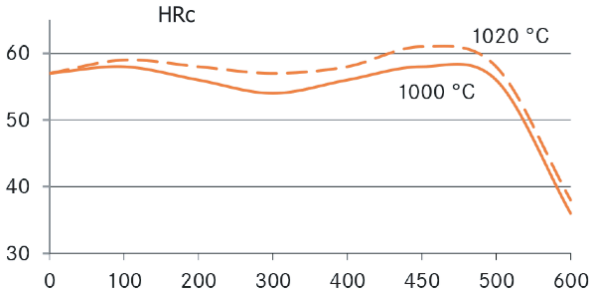
ANNEALING
Heat uniformly to 790-820 °C in controlled atmosphere furnaces or with suitable protective media, hold at temperature for two hours, and cool slowly in the furnace to below 500 °C.
NICRO 100 may then be cooled in air if desired. The annealed hardness is approximately BHN 250-310.

STRESS RELIEVING
After rough machining heat uniformly to 600-650 °C and hold 30 minutes for each 25 mm of thickness, one hour minimum, cool in the furnace or in air. A slow cool from the stress relief temperature is preferred.

HARDENING
In order to prevent any possibility of decarburization, denitrization or oxidation, it is desirable to use a controlled atmosphere furnace or vacuum furnace with a pressure of about $6x10^{-6}$ bar or higher.
Heat the parts thoroughly to 600-900 °C, raise temperature to the selected austenizing temperature inthe range of 985-1000 °C.
Soak time should be max. 40 minutes after through heating (probe 16mm).

QUENCHING
Quenching in oil, air or salt bath maintained at 500-550 °C.
When oil quenching is used, particularly for tools of large dimensions, it is good practice to use an interrupted quench. When air is used, minimum overpressure of 5 bar is necessary until maintaining 500 °C. No matter what method of quenching is used, the tools should be allowed to cool below 40 °C or to a temperature at which the tools may be held comfortably in the bare hands before tempering.

TEMPERING
Temper immediately after quenching, when the room temperature is reached, do a sub-zero treatment at -120 °C for at least 60 minutes or at -195 °C for 30 minutes.
Massive or complicated dies with risk of cracking or abnormal change of shape caused by heat treatment should first be tempered at 180 °C and than sub zero treated.
must be 2 x 2 hours each, with a temperature adjusted to achieve the desired hardness.



1° Preheat	600 - 650 °C
2° Preheat	850 - 900 °C
Austenizing	See chart below
Tempering	See chart below
Quenching	oil, gas or salt baht up to 550°C

HARDNESS	Aust. T.	Soak Time	Tempering
HRC ±1	°C	min.	nr. x time / temp.
54	985	40	2x2/280
56	985	40	2x2/260
58	985**	40	2x2/250
58	1000	30	CR/2x2/200
58	1000***	30	CR/2x2/200
60	1020	20	CR/2x2/460

NOTE:
The maximum temperature of 1020 °C must not be exceeded

** best combination for toughness and corrosion resistance

*** best combination for resistance to wear and tempering

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