

9.9440 Martensitic, UNS S42826, Surgical Steel

Medical – Data Sheet



Zapp is certified to ISO 9001

Stainless Surgical Steel Material 9.9440

The newly developed grade 9.9440 YL is a useful alternative alloy to steels with a high carbon content such as the AISI 440A/440B/440C (1.4109/1.4112/1.4125).

The positive feature of the high-hardness grade is preserved since the newly developed and well-aligned chemical composition and the huge primary carbides are avoided simultaneously.

Furthermore, corrosion resistance is increased since the grain boundary precipitation is suppressed. Wear resistance is assured through the accumulation of dispersed special carbides.

This alloy design allows for a better deformation capability and therefore a cheaper production compared to 440A.

Corresponding Standards

- AISI 440A Mod acc. to ASTM F899
- acc. to UNS S42826 (9.9440 YL)

Zapp® 9.9440 YL

Composition	Short symbol	Circa-value [%]
Carbon	C	0.6 – 0.75
Silicone	Si	1.00
Manganese	Mn	1.00
Phosphorus	P	0.04
Sulphur	S	0.03
Chromium	Cr	16.50 – 18.00
Molybdenum	Mo	1.00 – 1.50
Vanadium	V	0.10 – 0.30
Tungsten	W	0.10 – 0.30
Cobalt	Co	0,10 - 0,30

Heat Treatment

9.9440 YL	Forging and lamination	Soft annealing	Hardening	Tempering
Temperature [°C]	800 – 1,100	750 – 800	1,020 – 1,080	100 – 400
Period [h]	-	2 – 6	-	2
Quenching	Furnace		fast cooling	-

Mechanical Properties

(typical delivered condition: annealed+CW)

	Short symbol	Test result at 20 °C	Unit
Tensile strength	Rm	≤ 1000	MPa
0.2 % Yield stress	Rp 0,2	≤ 850	MPa
Elongation after fracture	A 50	10	%

Physical Properties

	Short symbol	Test result at 20 °C	Unit
Density	ρ	7.7	$\frac{\text{kg}}{\text{dm}^3}$
Specific heat	c	460	$\frac{\text{J}}{\text{kg} \cdot \text{K}}$
Heat conduction	λ	30	$\frac{\text{W}}{\text{K} \cdot \text{m}}$
Specific electrical resistance	ρ	0.65	$\frac{\Omega \cdot \text{mm}^2}{\text{m}}$
Young's modulus	E	215	kN/mm ²

Welding

This alloy is usually not welded due to its tendency to air harden.

If it needs to be welded, preheat to 260 °C, and post weld, treat at 732 – 760 °C for 6 hours followed by slow furnace cooling to avoid cracking.

Use similar filler metal and high heat inputs during operations.

Applications

- Instrumental steel
- Surgical applications

The 9.9440 in Comparison to Conventional Martensitic Steel with Significant Smaller Carbides

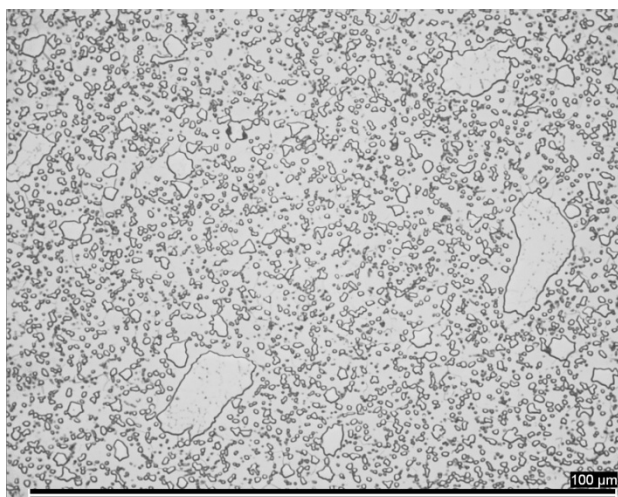


Image 1: Conventional, AISI 440B (1.4112)

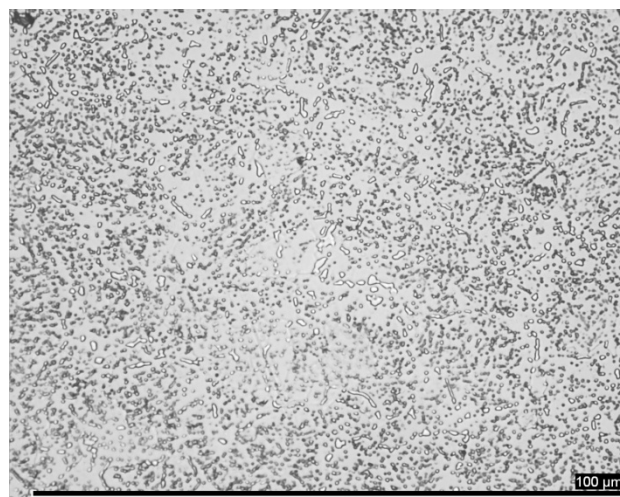


Image 2: Newly developed, 9.9440 YL

Corrosion Resistance of Zapp® 9.9440 YL

The reason of the reduced accumulation of chromium carbides is the limited carbon content.

Thereby more chrome is chemically active in the matrix which improves the corrosive resistance of the 9.9440 YL in comparison to the grades AISI 440A/440B/440C. Furthermore, corrosion resistance is improved due to the elevated Mo content.

Wear Resistance

Alloying concepts as the AISI 440C or AISI 440B and AISI 440A possess a high hardness of the matrix and many huge primary and secondary types of carbide.

Those carbides are wear resistant. However, they can be problematic when breaking out of the matrix because of their dimension.

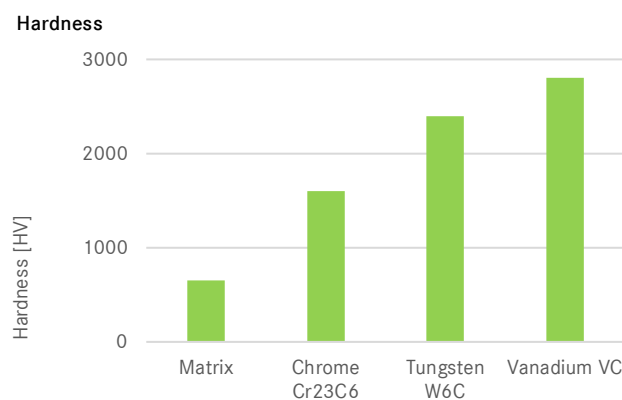
To minimize this risk, the carbon content has been reduced to a level that enables dispersed primary carbides. Thus, the break-out of the huge primary carbides is prevented, which improves abrasive wear.

Due to the alloying of vanadium and tungsten, very hard carbides are finely distributed in the matrix. These carbides have a much higher hardness than conventional chromium carbides, which significantly improves the resistance to wear, see diagram hardness.

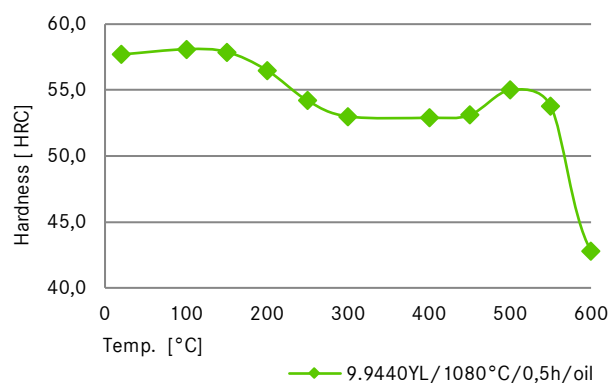
[Information](#)

about further medical applications at Zapp.

Image 1 illustrates the structure of conventional martensitic steel with high carbon content and huge primary carbides. The newly developed 9.9440 YL with clearly smaller carbides is represented in image 2.



Tempering Diagram 9.9440 YL



[Linecard](#) for instrumental grades.

[Linecard](#) of implant steels.

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