RWL 34

Highest edge strength

A Rapidly Solidified Powder Steel for Knife Blades

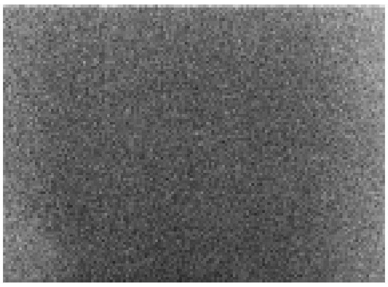
RWL 34

HARDENABLE MARTENSITIC STAINLESS STEEL FOR KNIFE BLADES MANUFACTURED BY RAPIDLY SOLIDIFIED POWDER TECHNOLOGY

RAPID SOLIDIFICATION

Advanced tool steels for cutting or blanking edges are today manufactured from rapidly solidified powders, RSP-tool steels. In Söderfors the ASP-steels (trade name) have been manufactured for 20 years. The ASP-steels have found applications in those parts of the mechanical industry where tool edge performance is essential.

The reason why the RSP-steels give superior performance is found in the solidification structure. Fig. 1 and 2 compare a rapidly solidified and a conventional microstructure.



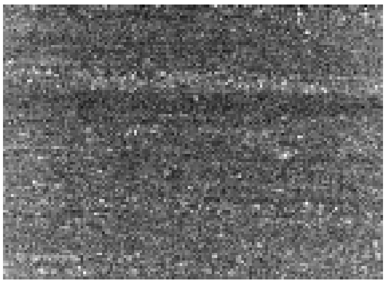


Fig 1. Rapidly solidified RWL 34 100x Fig 2. Conventional AISI 618. 100x

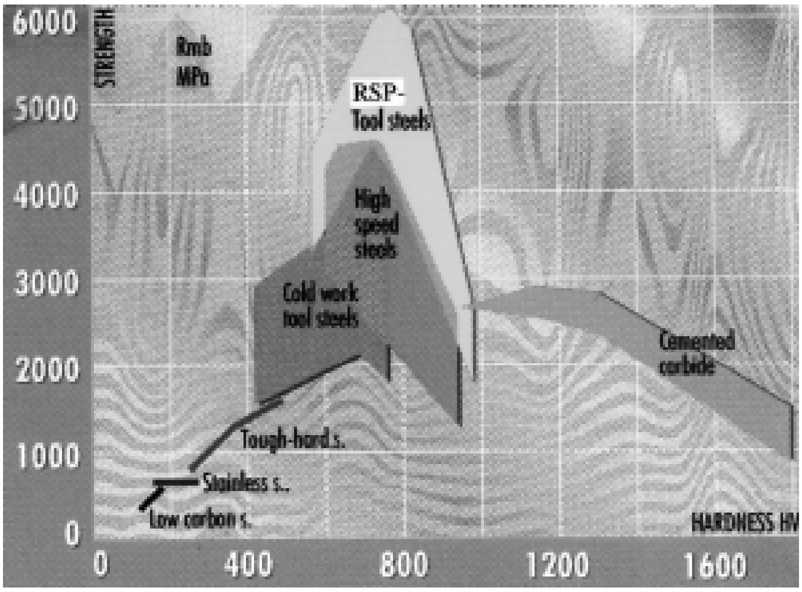


Fig 3. "Matterhorn" Hardness and fracture strength of some steel materials.

The coarse carbide structure of the conventional steels limits the fracture strength.
The carbide clusters act like fracture initiation sites on a certain stress level. The substantially smaller carbides in the rapidly solidified material inhibit fracture initiation until the stress level is nearly doubled.
The powder steels have around twice the fracture strength of conventional steels.
The best combination of hardness and strength is found mostly in the rapidly solidified powder steels. See fig 3.

RWL 34 COMPOSITION

C	Si	Mn	Cr	Mo	V	%
1.05	.50	.50	14	4	.20	

HOT WORKING

Forging - rolling temperature 1160 - 1050 C (2120 - 1920 F).
Melting occurs above 1220 C (2230 F). This means that the steel is relatively sensitive to overheating.
”Burning” can occur at too high a heating temperature. Deformation heat must be considered.
Long heating times lead to material losses from scaling and decarburization.
Slow cooling or step annealing after hot working prevents cracking.

SOFT ANNEALING

After hot working, soft annealing is needed.
Alt.1 Ferritic annealing is performed at 770 C (1420 F). Annealing time 3 hours at temperature. Hardness will be about 300 HV. Protective atmosphere or packing in cast iron mills can be used to avoid decarburization.
Alt.2 Transformation annealing starts at 865 C (1410 F), and after that a slow cooling by 10 deg C/hour (20 deg F/hour) down to 700 C (1300 F). Hardness will be below 250 HV. Protective atmosphere or packing to avoid decarburization.

HEAT TREATMENT - HARDENING

Hardening can be performed in a vacuum, salt or open-air furnace. In a muffle furnace surface oxidation and decarburization occurs.
This can be minimized but not totally prevented by the use of foils or protective paints.
Time at temperature 10 - 15 minutes. Heavier dimensions need more time.
Quenching should be fast from hardening temperature down to less than 800 C (1500F)
The cooling from 300 C down to room temperature can be slower.
The martensite formation can cause distortion if there are temperature gradients in the piece.
Tempering diagram, see fig. 4.

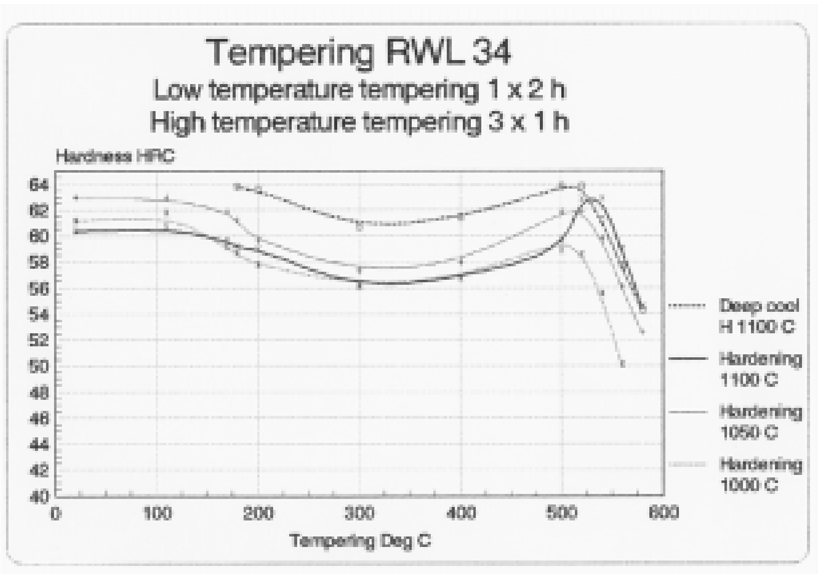


Fig. 4
Tempering
diagram

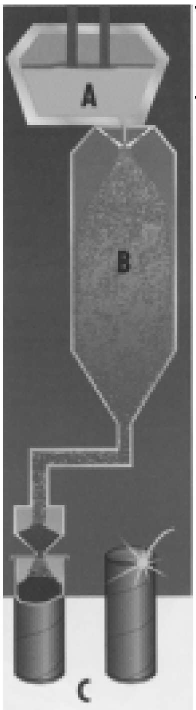
Product information

Stainless knife steel, RWL 34

HEAT TREATMENT RECOMMENDATIONS

	Hardening Temp. Deg. C/F	Tempering Temp. Deg. C/F	Tempering Time hours	Hardness HRC	Remarks
I.	1050/1920	220/430	1 x 2 h	59	Low temperature tempering for corrosion
II.	1050/1920	175/345	1 x 2 h	62	resistance
III.	1080/1980 +deep cooling	175/345 +deep cooling	1 x 2 h	63	”
VI.	1100/2010 +deep cooling	175/345 +deep cooling	1 x 2 h	63,5	”
V.	1050/1920	520/970	3 x 1 h	61	High temperature tempering for maximum edge sharpness.
VI.	1100/2010 +deep cooling	520/970 +deep cooling	3 x 1 h	64	”

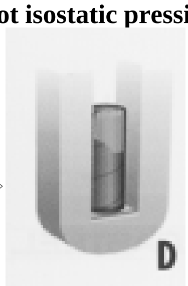
Deep cooling gives increased hardness, especially in combination with a high hardening temperature.
Deep cooling is - 80 C minus (- 144 F). Time, 10 minutes.
High temperature tempering reduces the corrosion resistance and should not be used for food handling applications.



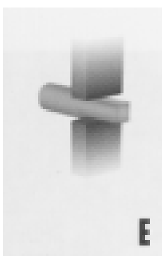
-- Graphite electrodes for heating and temperature regulation
-- Slag cover
-- Molten steel
-- Nitrogen gas
-- Altomization of molten steel with nitrogen gas

Atomization

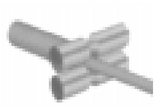
Hot isostatic pressing



Forging



Rolling



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Encapsulation of power in steel cylinder

Welding together of cylinder after vacuum