Product information

Martensitic stainless RWL34

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Damasteel's martensitic stainless RWL 34 is a Rapid Solidified Powder (RSP) based steel which is a variation of the 420 martensitic stainless steel with > 13 % Chromium. The addition of Molybdenum and Vanadium gives the RWL 34 even greater corrosion resistance, hardness and strength. This alloy may be considered for a wide variety of applications where one or more of the following properties are important:

- High edge strength
- High hardness after hardening and tempering
- High corrosion resistance
- Easy grinding and polishing
- High purity and cleanliness

The alloy represents an excellent combination of corrosion resistance and hardenability. This combination of properties is a reason for its impressive suitability as knife material.
Some examples of other applications are flatware cutlery and any other applications where corrosion resistance and hardness are important.

Grade	C	Si	Mn	Cr	Mo	V
RWL34	1,05	0,50	0,50	14	4	0,2

Table 1. Nominal chemical compositions in wt-% of RWL 34

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Mechanical and physical properties

Mechanical and physical properties of annealed RWL 34 (plate and sheet), minimum values at 20°C.

Yield strength, Rp 0,2	270	MPa	**Young's modulus**	200	GPa
Tensile strength, Rm	<700	MPa	**Poisson's ratio**	0,3	-
Elongation, A5	45	%	**Thermal conductivity**	15	W/m·K
Hardness	<700	HV	**Heat capacity**	460	J/kg·K
Density	7,8	kg/dm^3	**Electrical resistivity**	0,73	µ·Ω·m

Table 2. Mechanical and physical properties of Damasteel martensitic stainless RWL 34 in annealed condition.

Corrosion resistance

The martensitic stainless steels have a moderate to good corrosion resistance and are therefore suitable for a wide range of applications. The addition of Molybdenum gives RWL 34 a higher corrosion resistance compared to standard martensitic stainless steels.

Hot working

Hot working temperature 1050-1160 °C (1920-2120 F)

Compared to low alloyed steels, martensitic stainless steel has higher, almost doubled deformation resistance. Hand forging can therefore only be performed on relatively small dimensions. Melting starts at 1220°C (2230 F) which means that the material is very sensitive to overheating, see fig. 1. A good control of the heating temperature is needed. An electric or gas fired furnace is recommended. Long soaking times above 850°C (1560 F) leads to decarburization and scale formation.

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After the hot working process, a slow cooling is recommended due to the risk of cracks when the material phase transforms to martensite at around 200 °C (390 F). Usage of vermiculite or other heat insulating material is recommended.

Figure 1. Overheated material with its characteristic cracks from the edges towards the center of the piece.

Heat treatment

Because of the risk of cracking; no grinding, cutting or machining should be done after hot working until the material is annealed. The recommendation is to have the material fully transformation annealed which means one hour at 900 °C (1650 F), then cool to 750 °C (1380 F) during one hour and finally hold at 750 °C for four hours. All martensitic material supplied from Damasteel is soft annealed to 230 – 280 HV (20 – 28 HRC).

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Hardening

For knife applications the following heat treatments can be recommended for a 3,2 mm thick piece.

	Hardening temperature (A)	Tempering temperature (T)	Tempering time	Hardness
I	1050 °C 1920 F	220 °C 430 F	2 h	59 HRC
II	1050 °C 1920 F	175 °C 345 F	2 h	62 HRC
III	1080 °C 1980 F	220 °C 430 F	2 h	58 HRC
IV	1050 °C 1920 F	175 °C 345 F	2 h	63 HRC
V	1100 °C 2010 F	175 °C 345 F	2 h	64 HRC

Table 3. Hardening and tempering suggestions for a 3,2 mm thick piece with corresponding hardness of the steel

The suggested heat treatment processes IV and V includes deep freezing (DF) at -80°C (-110 F).
To ensure that best corrosion properties are achieved we recommend a low tempering temperature.
The following time temperature curve can act as a guide, see fig. 2 on the next page.

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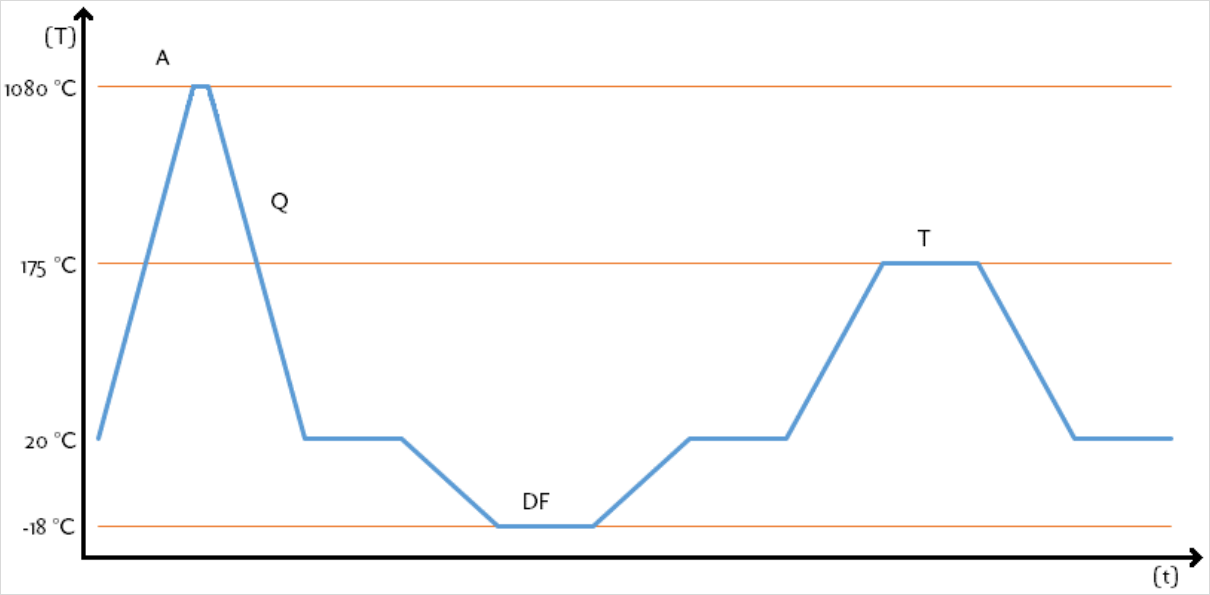

Figure 2: Schematic hardening and tempering curve

A Austenitizing. Holding time 8 min on a 3,2 mm thick piece. Increase or decrease that holding time with one minute per half mm of thickness.

Q Rapid cooling to room temperature. We suggest quenching in oil and that the piece reaches room temperature within two min. Apply some pressure on the piece if cooling in air so it will not bend due to uneven cooling

DF Deep freezing is not necessary but completes the martensite transformation and increases hardness. Hold for approx. one and a half hour

T Tempering. Holding time two hours

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Cold working

Martensitic stainless steel does not cold work as easily as the conventional austenitic stainless steels but can be formed and fabricated by a full range of cold working operations. The cold working ductility is good and any cold working process will increase the strength and the hardness of the material.

Welding

When cooling martensitic stainless steel after any hot process the martensitic phase transformation occur at around 200 °C and can lead to cracking. This can be avoided either by preheating the piece or do a post-weld heat treatment.
Our RWL 34 can be welded by a full range of conventional welding methods.

Machining

As with the conventional austenitic stainless steels, the martensitic steels have some specific machinability properties. The martensitic stainless steels are generally easier to machine than other stainless steel grades. The machining characteristics for our martensitic stainless RWL 34 are

- Low tensile strength but a strong work hardening
- Tendencies for buildup of material on the tool edge
- Tough and stringy chips can be prevented by using chip curler tools

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Grinding and polishing

Normal grinding and polishing procedures for austenitic stainless can be used also for the martensitic stainless steel.

Grinding wheel recommendation:
Silicon Carbide, 46 grit, soft, open density, ceramic bonded. (C46J6V)

- Speed: 35 m/sec
- Feed: 0.01-0.05 mm/stroke

Speed of the work piece may be 1/60 of the grinding speed.

Hardening process

1. Grind the piece flat and into desired shape with grit 60 and 120
2. Harden by following the instruction on the previous page
3. Fine grind and polish with a fine trundle with wax
4. Grind the final edge if you are making a knife

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Products and dimensions

Damasteel has a standard product program that can be found on our website www.damasteel.com.

We make our RWL34 in following formats

- Plate
- Sheet
- Strip
- Bar
- Rod
- Billet

Even if it comes to creating customized patterns on our damascus products or if you like dimensions outside our standard range either on damascus, RWL34 or Nitrobe 77 – do not hesitate to contact us at sales@damasteel.se or +46 293 30600

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