

# DAMASTEEL® DAMACORE DC18N™ MARTENSITIC PATTERNED STEEL

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Damasteel's stainless Damascus patterned steel, Damacore DC18N™ is a powder metallurgy-based steel with three different alloys. The center core consists of N11X™, a high nitrogen steel with distinctive properties. The Damascus patterned outer layers consists of RWL34™ and PMC27™. These three alloys combined in Damasteel's process gives the Damacore DC18N™ unique and exceptional properties that combines beauty and function.

N11X™ is a Cr-Mo-V-N alloyed steel characterized by:

- Excellent corrosion resistance
- High mechanical strength
- Good ductility
- Good mixed wear resistance
- Good through hardening properties
- Good dimension stability at hardening

Via a process route based on powder metallurgy a high nitrogen steel is produced with unique property combinations of hardness, wear resistance, ductility and corrosion resistance. In N11X™ most of the carbon is substituted by nitrogen, modifying the traditional chromium carbides into carbonitrides. These carbonitrides are less harmful when it comes to corrosion resistance compared to chromium carbides.

RWL34™ and PMC27™ are both variations of the martensitic stainless steel 420 type with a minimum of 13 percent chromium content. These alloys may be considered for a wide variety of applications where one or more of the following properties are important:

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

Each alloy represents a good 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, jewelries, and any other products where corrosion resistance and hardness are important.

These three grades combined in Damasteel's process gives the Damacore DC18N™ unique properties that until now has not been possible to produce.

Grade	Etch color	C	Si	Mn	Cr	Mo	V	N
N11X™	Grey	0,36	0,3	0,3	18,2	1,1	3,5	1,55
RWL34™	Bright	1,05	0,50	0,50	14	4	0,2	
PMC27™	Dark	0,60	0,50	0,50	13	-	-	-

Table 1. Nominal chemical compositions in wt-% of the constituent alloys

## Hardening

It is recommended that all hardening including heating, cooling, cryogenic and tempering operations should be performed before grinding or machining bevel to protect the center core material. Hardening can be performed in normal atmosphere with the use of heat treatment foil wrap. If hardening is performed using vacuum furnace a nitrogen partial pressure of 150–200 mbar should be applied to counteract loss of N on the surface. The recommended austenitizing temperature is 1080°C (1975 F) with 30 minutes holding time. Subsequent cooling in air to 50–70°C (120–160 F) followed by deep cooling between -100°C (148°F) and -196°C (-320°F) to minimize the amount of retained austenite. For best corrosion properties low temperature tempering at 200°C (390°F)/2 x 2h is recommended. If the product application conditions require a higher tempering temperature Damacore DCi8N™ can be tempered up to 450°C (840°F) without significant loss of corrosion properties. The hardenability is adequate to ensure good through hardening properties when gas quenching in vacuum furnaces.

## Etching

To make the pattern in our steel visible, etching must be made. Depending on desired result, different acids and acids mixtures can be used. The surface finish is also influencing the result. In the below table below are a suggestion.

	Acid	Chem. comp.	Blend (%)	Time (min)	Color RWL34™	Color PMC27™	Color N11X™
I	Hydrochloric acid 37 %	HCl	100	2-5	Bright grey	Dark grey	Grey

**Note: A small amount of FeCl<sub>3</sub> can be mixed within the HCl acid to further darken the etch.**

Table 4. Etching suggestions with corresponding colors and relief of the different alloys

1. Grind the piece progressively up to desired grit, 600 or higher. Finish off with polishing if desired.
2. Clean and degrease the piece carefully.
3. Mix the etching acid in the recommended ratios and remember to always pour the acid into the water.
4. Immerse the piece in the mix and leave it in for the time you choose. Longer soaking time will give deeper etch.
5. Neutralize the piece by dipping it into water with bicarbonate.

Beware of noxious fumes. Acids must be handled with great care.

## Products and dimensions

Damasteel has a standard product program that can be found on our website [www.damasteel.com](http://www.damasteel.com).

We supply Damasteel® Damacore DCi8N™ in bars in various thicknesses and widths. Please refer to our product program.

Even if it comes to creating customized patterns on our Damascus products or if you like dimensions outside our standard range either on our Damascus patterned steel grades (Damacore™, DS93X™, DS95X™, DS92X™, DS96X™) or our martensitic steels RWL34™ or Nitrobe77™ – do not hesitate to contact us.

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