



289 Wagaraw Road, Hawthorne NJ 07506
njsteel@njsteelbaron.com
SteelBaron.com
973-949-4140

CPM® M-4 | Heat Treating

[About CPM® M-4](#) **2**

Machinability 2

Alloy Chemistry % 2

[About CPM® M-4](#) **3**

Blade Steel Comparagraph 3

[About CPM® M-4](#) **4**

Physical Properties 4

Grindability 4

[Heat Treating](#) **5**

Important - Before Treating 5

Cyrogenic Treatment 5

[Heat Treating](#) **6**

Tempering 6

[Heat Treating Disclaimer](#) **7**

CPM® M-4 | Heat Treating

About CPM® M-4

CPM REX M4HC(HS) is a high-vanadium special purpose high speed steel exhibiting better wear resistance and toughness than M2 and M3 in cold work punches, die inserts and cutting applications involving high speed and light cuts.

The high carbon (HC) modification to standard M4 is designed to provide optimum hardening response in large cross-section tools or in vacuum or atmosphere heat treating. The high sulfur (HS) modification is standard for large diameter bars providing enhanced machinability and grindability.

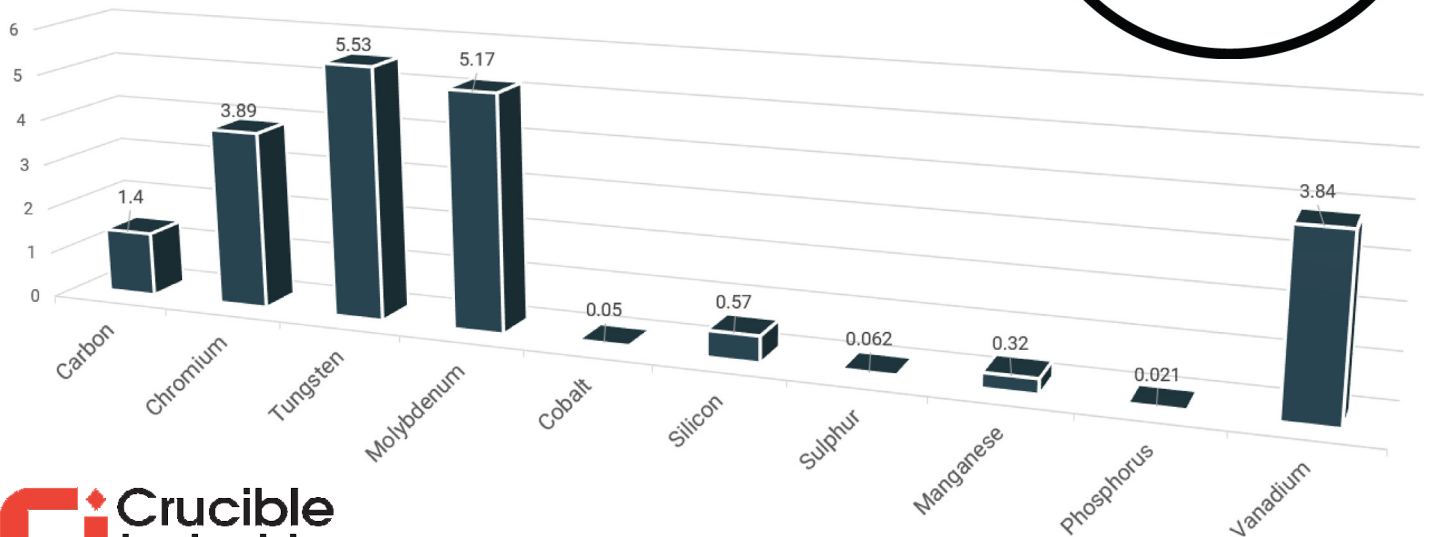
The CPM process produces very homogeneous, high quality steel characterized by superior dimensional stability, grindability, and toughness compared to steels produced by conventional processes.

Machinability

In the annealed condition, the machinability of CPM Rex M4 HC(HS) is approximately 45% of W1 tool steel (1% C) with additional improvement of about 30% for the high sulfur (HS) modification.



Alloy Chemistry %



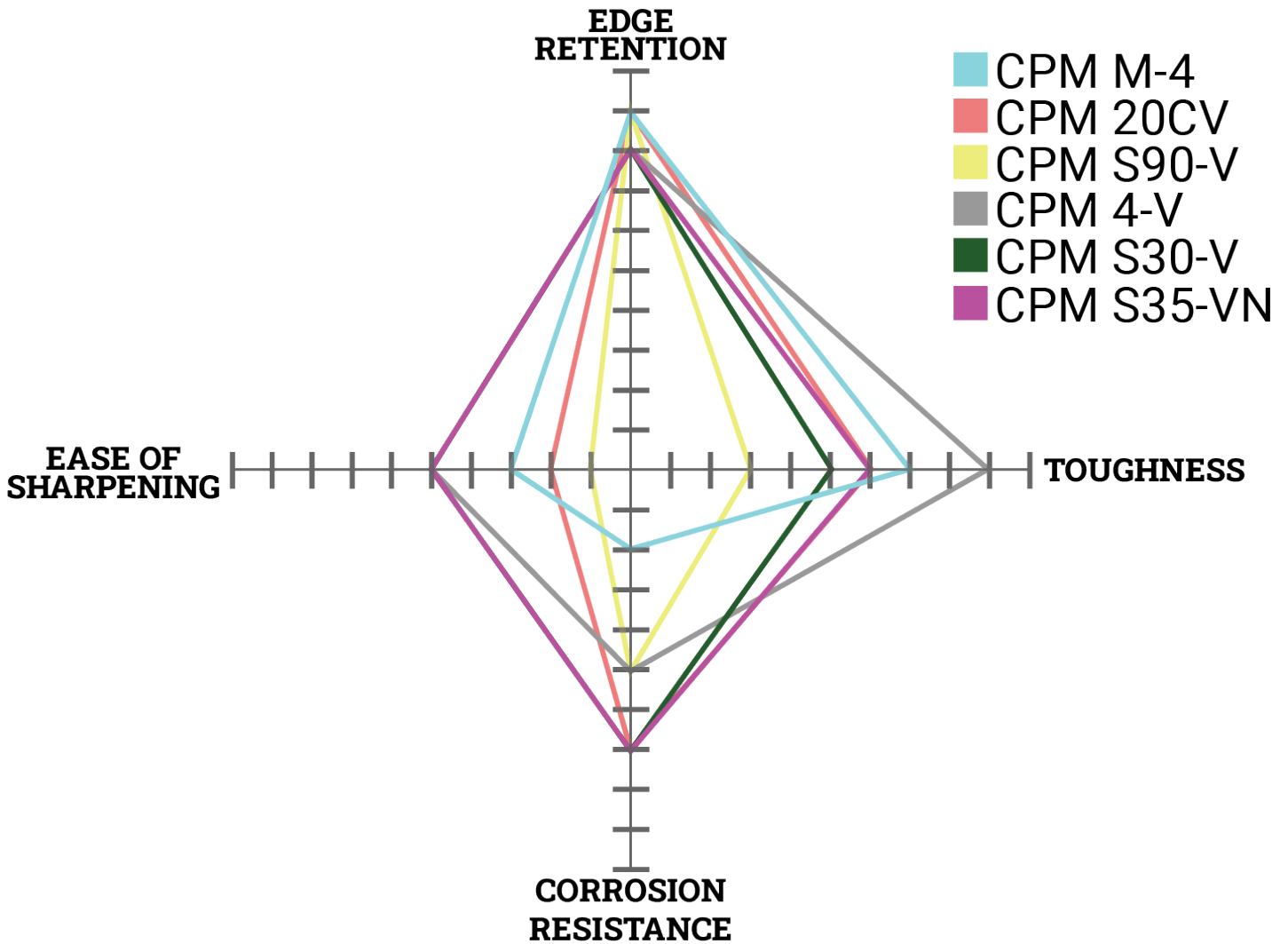


289 Wagaraw Road, Hawthorne NJ 07506
njsteel@njsteelbaron.com
SteelBaron.com
973-949-4140





CPM® M-4 | Heat Treating

About CPM® M-4

Blade Steel Comparagraph





 289 Wagaraw Road, Hawthorne NJ 07506
 njsteel@njsteelbaron.com
 SteelBaron.com
 973-949-4140

CPM® M-4 | Heat Treating

About CPM® M-4

Physical Properties

Elastic Modulus	31 X 10 ⁶ psi	(214GPa)
Specific Gravity	7.97	
Density	0.288 lbs./in ³	(7.97 g/cm ³)

Thermal Conductivity

	BTU/hr-ft-°F	W/m-°K	cal/cm-s-°C
at 72°F (22°C)	10.98	18.99	4.54X10 ⁻²
at 212°F (100°C)	12.03	20.82	4.97X10 ⁻²
at 392°F (200°C)	13.26	22.95	5.48X10 ⁻²
at 572°F (300°C)	13.85	23.96	5.72X10 ⁻²
at 752°F (400°C)	14.28	24.71	5.90X10 ⁻²
at 932°F (500°C)	14.78	25.58	6.11X10 ⁻²
at 1004°F (540°C)	15.07	26.09	6.23X10 ⁻²

Coefficients of Thermal Expansion





	in/in/°F	mm/mm/°C
100 to 500°F (40 to 260°C)	6.40X10 ⁻⁶	11.5X10 ⁻⁶
100-800°F (40-425°C)	6.58X10 ⁻⁶	11.8X10 ⁻⁶
100-1000°F (40-540°C)	6.72X10 ⁻⁶	12.1X10 ⁻⁶

Grindability

Because of its uniform distribution of fine carbides, the grindability of CPM Rex M4 HC(HS) compares favorably with that of conventional high speed steels. Grinding wheels designed for conventional high speed steels can be used. In special cases, the advice of a grinding wheel manufacturer should be sought.





 289 Wagaraw Road, Hawthorne NJ 07506
 njsteel@njsteelbaron.com
 SteelBaron.com
 973-949-4140

CPM® M-4 | Heat Treating

Heat Treating

Important - Before Treating

- Knives should be cleaned by washing with soapy water and then either placed into foil pouch or coated with high temperature anti-scale/decarburization compound prior to heat treat if not using Oxygen free heat treat equipment.
- Skipping stages such as pre-heating and equalizing or cryo will result in lower hardness, higher amounts of Retained Austenite (RA), impaired stain resistance or other issues. Ramp AFAP (as fast as possible) between preheating and austenizing temps.
- Clamping flat after quench during cryo or tempering recommended to avoid thermal shock induced warp.
- **Figures represent quenching under positive pressure with aluminum plates and compressed air to at or below 125°F / 50°C--alternative quenching methods may present lower hardness, high RA, or other issues.**



Pre-Heat/Equalizing	Pre-Heat/Equalizing	Austenizing Temperature	Expected RC (as quenched prior to cryo)
1,500°F / 815°C Hold 5 minutes	1,800°F / 982°C Hold 5 minutes	2,100°F / 1,175°C Soak 15 minutes	64Rc (65 after Cryo)

Cryogenic Treatment

- A cryogenic treatment is recommended to convert retained austenite, and can either be done before or after the first temper cycle.
- While liquid nitrogen is preferred, a sub zero bath with dry ice and kerosene will suffice for -100°F / -74°C.
- Submerge in sub-zero treatment 4-6 hours depending on thickness and number of blades.
- **A cryogenic treatment can be done immediately done after quench, but it is recommended blades be clamped flat to avoid thermal shock induced warp--cryo treatment should always be followed by a tempering cycle.**





289 Wagaraw Road, Hawthorne NJ 07506
njsteel@njsteelbaron.com
SteelBaron.com
973-949-4140

CPM® M-4 | Heat Treating

Heat Treating

Tempering

- Once blade is quenched and near ambient temperature, blades should be tempered accordingly, the times suggested are to ensure even, consistent temperature.
- Figures supplied are as representative of industrial standards.
- **If using a small toaster oven or household kitchen oven for tempering, using a blade holding rack made from kiln furniture, a roasting tray lined with fine sand, or similar large object will help retain thermal mass to reduce wide swinging temperatures as the device fluctuates trying to maintain temperature.**
- **Note: Final hardness values vary based on initial as-quenched hardness and percentage of conversion to Martensite. Only reliable testing methods, e.g. calibrated Rockwell hardness tester, can provide actual hardness values--hardness calibrated files and chisels are relative testing methods and inaccurate for true hardness value reading.**
- Temper twice for 2hrs.



Temperature:	Hardness (2 hour x2 guideline):
1,000°F / 537°C	64
1,025°F / 551°C	63
1,050°F / 565°C	62
1,100°F / 593°C	60

- **The included Heat Treat Schedule on this page is formulated based upon Industry standards and data from ASM International, Crucible and other foundry spec sheets, and Kevin Cashen (independent researcher, ferroalloy metallurgist, and bladesmith of Matherton Forge).**





📍 289 Wagaraw Road, Hawthorne NJ 07506
✉ njsteel@njsteelbaron.com
🌐 SteelBaron.com
☎ 973-949-4140

CPM® M-4 | Heat Treating

Heat Treating Disclaimer

- Suggested heat treatment are based on the recommended specifications for use in ovens, high temp salts, and similarly, properly calibrated equipment; and in line with proper industrial standards for quenching. Deviation from industry standards for schedules, equipment, quenching mediums; and hardness testing equipment may result in varied results. The supplied information on this page is on a generalized scale with the above mentioned standards and methods, which is why soak times and similar aspects may vary in time length to include a margin for the available heat treating equipment and steel cross section.
- If you are unsure if you have the necessary means to heat treat on-site, we recommend professional heat treating services provided by Peters Heat Treat or Bos Heat treating; or industry specific services by knife material dealers such as TruGrit or Texas Knifemaker's Supply--check with suppliers to see if they offer HT services and ensure they follow industry standards.
- NJSB LLC is not liable or responsible if proper industry heat treating protocols are not applied; particularly and especially if sending to an independent heat treat provider if they do not follow the intended heat treat schedule or standards for that particular steel; or damage they cause while in their possession.

