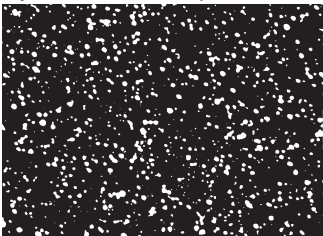


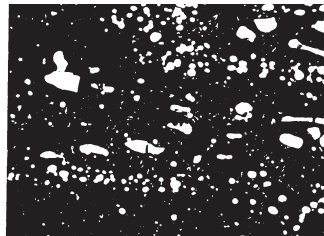
CRUCIBLE

CPM S30V is a martensitic stainless steel designed to offer the best combination of toughness, wear resistance and corrosion resistance. Its chemistry has been specially balanced to promote the formation of vanadium carbides which are harder and more effective than chromium carbides in providing wear resistance. CPM S30V offers substantial improvement in toughness over other high hardness steels such as 440C and D2, and its corrosion resistance is equal to or better than 440C in various environments.

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



CPM Steel

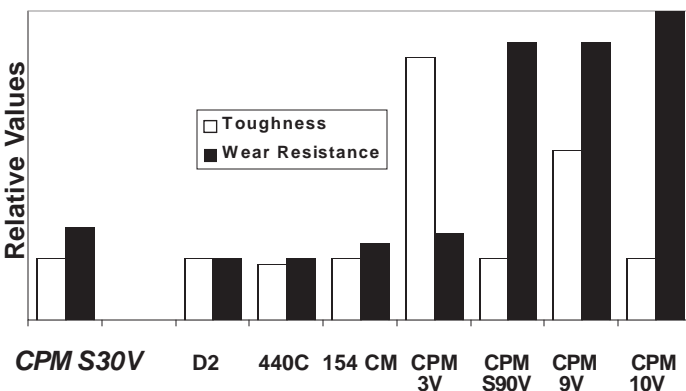


Conventional Steel

Carbide Type and Volume

	Vanadium-Rich	Chromium-Rich	Total
CPM S30V	4%	10.5%	14.5%
440C	0%	12.0%	12.0%
154 CM	0%	17.5%	17.5%
CPM S90V	9%	11.0%	20.0%

Tool Steel Comparagraph



Typical Applications

- Long-Wearing Specialty Cutlery
- Plastic Injection and Extrusion Feed Screws and Dies
- Non-Return Valve Components
- Pelletizing Equipment
- Wear Components for Food and Chemical Processing

Note: These are some typical applications. Your specific application should not be undertaken without independent study and evaluation for suitability.

Crucible Industries LLC

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DATA SHEET

CRUCIBLE CPM® S30V®

Issue #1

Carbon	1.45%
Chromium	14.00%
Vanadium	4.00%
Molybdenum	2.00%

Physical Properties

Elastic Modulus	32 X 10 ⁶ psi	(221 GPa)
Density	0.27 lbs./in ³	(7.47 g/cm ³)
Thermal Conductivity		
	BTU/hr-ft-°F	W/m-°K
200°F 93°C	10	17.31
		cal/cm-s-°C
		4.13 X 10 ⁻²

Coefficient of Thermal Expansion

°F	°C	in/in/°F	mm/mm/°C
70 - 400	(20 - 200)	6.1 X 10 ⁻⁶	(11.0 X 10 ⁻⁶)
70 - 600	(20 - 315)	6.4 X 10 ⁻⁶	(11.5 X 10 ⁻⁶)

Mechanical Properties

Toughness (Transverse Charpy C-notch Testing)

Grade	Impact Energy
CPM S30V	10.0 ft. lbs.
154CM	2.5 ft. lbs.
440C	2.5 ft. lbs.

Although the longitudinal toughness for all three of these grades is about 25-28 ft. lbs., the *transverse* toughness of CPM S30V is four times greater than that of 440C or 154CM. These higher transverse toughness results indicate that CPM S30V is much more resistant to chipping and breaking in applications which may encounter side loading. In knifemaking, its higher transverse toughness makes CPM S30V especially good for bigger blades.

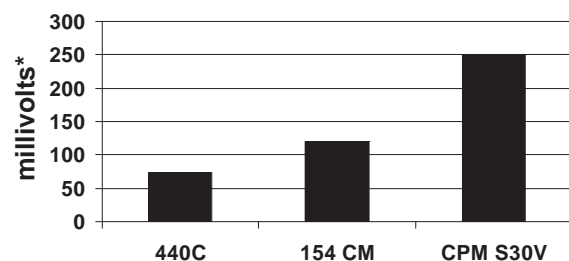
Edge Retention (CATRA Testing Relative to 440C)

Grade	%
CPM S30V	145
154CM	120
440C	100

The CATRA (Cutlery & Allied Trades Research Association) test machine performs a standard cutting operation and measures the number of silica impregnated cards which are cut (TCC = total cards cut). It is considered a measure of relative wear resistance.

Corrosion Resistance

Average Pitting Potential measurements from Polarization Curves run in 5% NaCl (Sodium Chloride) Solution at Room Temperature: (Higher voltage pitting potential indicates better corrosion resistance.)



*vs. Hg/HgO reference electrode

Thermal Treatments

Forging: 2100°F (1150°C) Do not forge below 1750°F (950°C).

Annealing: Heat to 1650°F (900°C), hold 2 hours, slow cool no faster than 25°F (15°C) per hour to 1100°F (595°C), then furnace cool or cool in still air to room temperature.

Annealed Hardness: About BHN 255

Stress Relieving

Annealed Parts: Heat to 1100-1300°F (595-705°C), hold 2 hours, then furnace cool or cool in still air.

Hardened Parts: Heat to 25-50°F (15-30°C) below original tempering temperature, hold 2 hours, then furnace cool or cool in still air.

Straightening: Best done warm 400-800°F (200-430°C)

Hardening

Preheat: Heat to 1550-1600°F (845-870°C) Equalize.

Austenitize: 1900-2000°F (1035-1095°C), hold time at temperature 15-30 minutes.

Quench: Air or positive pressure quench (2 bar minimum) to below 125°F (50°C), or salt or interrupted oil quench to about 1000°F (540°C), then air cool to below 125°F (50°C).

Temper: Double temper at 400-750°F (200-400°C). Hold for 2 hours minimum each time. (See Table) A freezing treatment may be used between the first and second tempers. Freezing treatments help to attain maximum hardenability and must always be followed by at least one temper.

NOTE: For optimum stress relieving, CPM S30V may be tempered at 1000-1025°F (540-550°C). Tempering in this range may result in a slight decrease in corrosion resistance.

Size Change: +0.05 to +0.10% when fully martensitic. The presence of retained austenite may reduce the net growth. When tempering at 400-750°F (200-400°C), freezing treatments may be necessary to minimize retained austenite.

Recommended Heat Treatment:

Austenitize 1950°F (1065°C). Quench to below 125°F (50°C). Double temper at 600°F (315°C) 2 hrs. minimum each temper. Cool to hand warm between tempers. A freezing treatment may be added between tempers.

Aim hardness: 58-61 HRC.

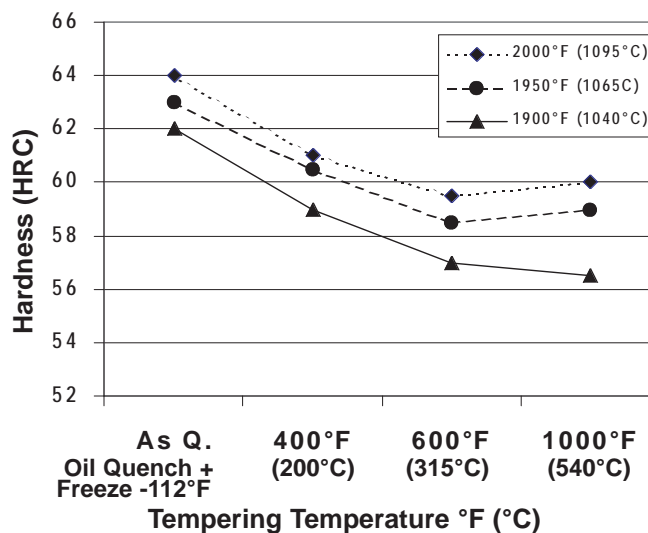
Note: Properties shown throughout this data sheet are typical values. Normal variations in chemistry, size and heat treat conditions may cause deviations from these values.

Heat Treat Response - Hardness (HRC)

Tempering Temperature	Austenitizing Temperature					
	1900°F (1040°C)		1950°F (1065°C)		2000°F (1095°C)	
	Oil	Oil + Freeze -112°F	Oil	Oil + Freeze -112°F	Oil	Oil + Freeze -112°F
As Quenched	60.5	62	62	63	63.5	64
400°F (200°C)	57.5	59	57.5	60.5	59.5	61
600°F (315°C)	57.5	57	59	58.5	59	59.5
1000°F (540°C)	57	56.5	59.5	59	58.5	60

Results may vary with hardening method and section size. Salt or oil quenching will give maximum response. Vacuum or atmosphere cooling may result in up to 1-2 HRC points lower.

Minimum Time at Aust. Temp.	30 min.	30 min.	15 min.
Minimum Number of Tempers	2	2	2



Machinability and Grindability

In the annealed condition, CPM S30V is much easier to machine than CPM S90V and is comparable to that of D2. Similar grinding equipment and practices used for high speed steels are recommended. "SG" type alumina wheels or CBN wheels have generally given the best performance with CPM steels.



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