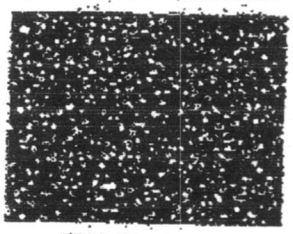
CRUCIBLE CPM® 154

Data Sheet

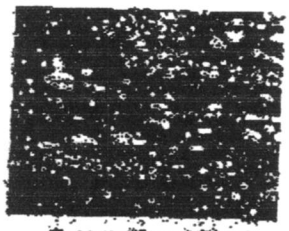
Issue #1

CPM 154 is CPM-manufactured version of Crucible's standard 154 CM. The CPM manufacturing process produces a uniform distribution of the carbides in this grade, giving this CPM 154 easier grinding and polishing, plus better toughness, than conventional 154 CM, while retaining similar heat treat response and wear properties. CPM 154 offers better corrosion resistance, better wear resistance and better hot-hardness than 440C, plus higher toughness. For knifemakers, it offers better edge retention and chipping resistance than 440C.

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



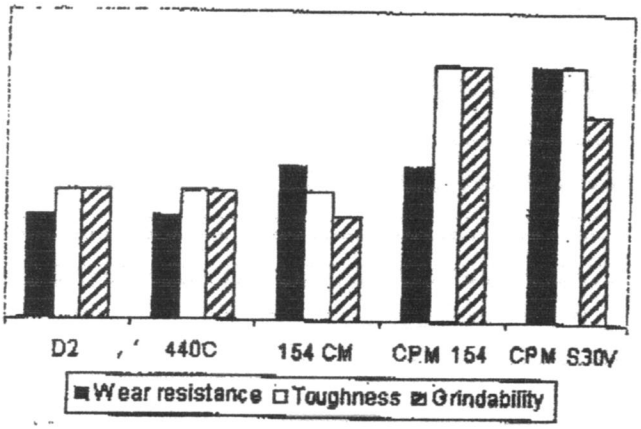
Conventional Steel

Typical Applications

Cutlery Bearings
Corrosion resistant tooling

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

Blade Steel Comparagraph



Crucible...

THE TOOL STEEL PROS ®

Carbon	**1.05%**
Chromium	**14.00%**
Molybdenum	**4.00%**

Physical Properties

Elastic Modulus	30 X 10^6 psi	(207 GPa)
Density	0.281 lbs./in^3	(7.78 g/cm^3)

Thermal Conductivity

	BTU/hr-ft- F	W/m-°K	cal/cm-s-°C
at 200°F (95°C)	14.0	24.2	0.057

Coefficient of Thermal Expansion

	in/in/ F	mm/mm/° C
-100 to 70°F (-74 to 21°C)	3.90X10^{-6}	7.02X10^{-6}
70-100°F (21-38°C)	4.07X10^{-6}	7.33X10^{-6}
70-300°F (21-149°C)	5.75X10^{-6}	10.35X10^{-6}
70-500°F (21-260°C)	6.06X10^{-6}	10.91X10^{-6}

Machinability

Because of the CPM processing, CPM 154 is easier to machine and grind than standard 154 CM. General machining parameters are similar to 154 CM and 440C.

Mechanical Properties

Grade	Hardness (HRC)	Wear Resistance*	Total Carbide Volume
154 CM	58.5	49 mg	17.5%
440C	57.5	86 mg, 55 mg	12%

* Wear resistance measured by the pin abrasion method. Lower number (mg.) is a lower weight loss (in mg.) and therefore better wear resistance.

Hot Hardness

Heat Treatment	Initial HRC	HRC tested at 400°F (204°C)	500°F (260°C)	600°F (315°C)	Final HRC
A	62	59	58	55	60
B	62	-	-	55	62
C	64	-	-	57	64

(A) Austenitized at 1950°F 1 hr., Oil Quench, cryo treated, tempered 600°F 1hr
(B) Austenitized at 1950°F 1 hr., Oil Quench, cryo treated, tempered 1000°F 1hr
(C) Austenitized at 2000°F 20 min., Oil Quench, cryo treated, tempered 1050°F 1hr

Thermal Treatments

Annealing: Heat to 1650°F (900°C), hold 2 hrs., slow cool no faster than 25°F (15°C) per hour to 1200°F (650°C), then furnace cool or cool in still air to room temperature. Crucible 154 CM can be cycle annealed by heating to 1600°F (900°C). hold 2 hrs., cool to 1300°F (704°C), hold 4 hrs., then air cool.

Annealed Hardness: About BHN 235

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 the original tempering temperature, hold 2 hours, then furnace cool or cool in still air.

Hardening

Preheat: Heat to 1400°F (760°C) Equalize.
Austenitize: 1900-2000°F (1037-1093°C), hold time at temperature 30-60 minutes.

Quench: Oil or positive pressure (4 bar minimum) to below 125°F (50°C), or salt quench to about 1000°F (540°C), then air cool to below 125°F (50°C). Salt bath treatment, if practical, will ensure the maximum attainable toughness for a given hardening treatment.

Temper: Twice at 400-1200°F (204-650°C), 2 hours minimum each time.

Note: As with all martensitic stainless steels, tempering at 800-1100°F (425-600°C) will result in sensitization which causes a minor reduction in both corrosion resistance and toughness. We recommend that this tempering range be avoided.

Aim hardness: HRC 55-62

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. For additional data or metallurgical engineering assistance, consult your local Crucible Service Center.

Heat Treat Response

	Hardness HRC					
	Austenitizing Temperature					
Tempering Temperature	1900°F (1038°C)		1950°F (1065°C)		2000°F (1093°C)	
Time at Temp.	1 hr.		1 hr.		30 min.	
Quench (*Optional Freeze)	Oil	Oil & Freeze	Oil	Oil & Freeze	Oil	Oil & Freeze
As Quenched	62	63	61	63	54	63
400°F (204°C)	59	60	59	62	52	62
600°F (315°C)	56	59	56	60	50	60
800°F (427°C)	56	56	57	60	50	61
900°F (482°C)	56	57	58	61	52	61
1000°F (540°C)	54	58	60	61	54	63
1050°F (565°C)	51	52	55	56	52	58
1100°F (593°C)	47	48	47	48	49	51
1200°F (649°C)	43	44	45	46	45	47
Time at Temp.	2 hrs.		2 hrs.		2 hrs.	
No. of Tempers	2		2		2	

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.

Recommended Heat Treat Practice

To completely transform any retained austenite, a freezing treatment with dry ice at -100°F (-74°C) is recommended either after the quench or in between the two tempers. The freezing treatment is most effective right out of the quench, however complex parts with sharp corners are more safely frozen between the two tempers. Thin sections can be successfully quenched in forced air and will obtain results to those in the table above.

Surface Treatments

If surface treatments such as CVD, PVD, or nitriding are used, ensure that the coating process temperature is below the tempering temperature.
Note: Nitriding will reduce the corrosion resistance of Crucible 154 CM or any other stainless steel.

Service Center Locations

Location	Phone	Toll Free	FAX
Auburn, MA	508-832-5353	800-365-1101	508-832-2217
Charlotte, NC	704-372-3073	800-365-1160	704-342-0985
Chicago, IL	630-378-0093	800-365-1151	630-378-1965
Cincinnati, OH	513-771-1310	800-365-1163	513-771-0119
Cleveland, OH	330-562-3131	800-365-1132	330-562-7818
Columbus, OH	614-2624959	800-365-1131	614262-7850
Dallas, TX	817-6492800	800-365-1168	817-633-8142
Detroit, MI	248-528-0332	800-365-1133	248-528-1977
Grand Rapids, MI	616-554-9699	800-365-1137	616-554-9328
Huntsville, AL	256-772-0201	800-365-1161	256-772-3361
Indianapolis, IN	317-638-4501	800-365-1146	317-634-7375
Los Angeles, CA	323-775-7344	800-365-1179	310-830-9784
Meadville, PA	814-337-8804	800-365-0530	814-337-8808
Milwaukee, WI	262-781-6710	800-242-0948	262-781-6743
Minneapolis, MN	612-331-6320	800-365-1153	612-331-4137
St. Louis, MO	636-272-7220	877-201-4049	636-978-9559
Canada			
Wallaceburg, ONT	519-627-2245	800-265-5293	519-627-2247
Mexico (SISA)			
Monterrey, N.L.	52-818-351-7220		52-818-351-2981
Naucalpan, E de M	52-555-576-4011		52-555-360-1865

CRUCIBLE SERVICE CENTERS DIVISIONAL HEADQUARTERS:
Camillus, NY 315-487-0800 800-365-1185 315-487-4028
www.crucibleservice.com email: crucible@crucibleservice.com

Crucible Service Centers
A Division of Crucible Materials Corporation

DS311 11/03 154 CM 8Crucible Materials Corp Printed in U.S.A.