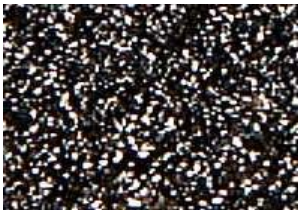
CRUCIBLE

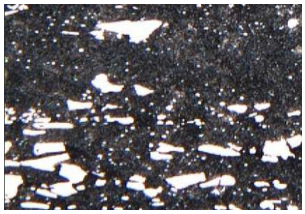
DATA SHEET

CPM 20CV is a unique tool steel made by the Crucible Particle Metallurgy Process. It is a martensitic stainless steel with a high volume of vanadium carbides for exceptionally good wear resistance. CPM 20CV contains the highest amount of chromium of any high-vanadium stainless steel currently available. The chromium rich matrix provides outstanding corrosion resistance. CPM 20CV an excellent steel for plastic injection feed screws, barrel liners, screw tips and mold cavities, especially for plastic resins which contain abrasive fillers.

The CPM process results in a finer, more uniform carbide distribution imparting improved toughness and grindability to highly alloyed steels. The CPM process also alloys for the design of more highly alloyed grades which cannot be produced by conventional steelmaking.



CPM Steel



Conventional Steel

CRUCIBLE CPM® 20CV

Issue #1

Carbon	**1.9%**
Chromium	**20.0%**
Vanadium	**4.0%**
Molybdenum	**1.0%**
Tungsten	**0.6%**

Physical Properties

Density: 0.275 lb/in3 (7616 kg/m3)

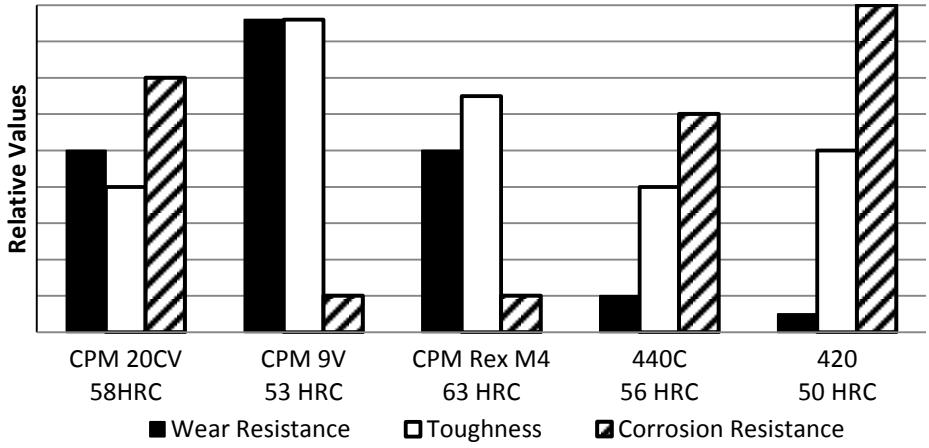
Modulus of Elasticity: 31x106 psi (214 GPa)

Machinability: 35-40% of a 1% carbon steel

Coefficient of Thermal Expansion:

Temperature °F	in/in/ °F x 10^{-6}	Temperature °C	mm/mm/ °C x 10^{-6}
68 - 212	6.06	20 - 100	10.9
68 - 392	6.23	20 - 200	11.2
68 - 572	6.56	20 - 300	11.8
68 - 752	6.73	20 - 400	12.1
68 - 932	6.84	20 - 500	12.3

Steel Comparagraph



Typical Applications

High Performance, Long-Wearing Specialty Cutlery

Plastic Injection and Extrusion Feed Screws and Dies

Granulator Knives

Pelletizing Equipment

Wear Components for Food and Chemical Processing

Edge Retention

(CATRA Test Relative to 440C)

GRADE	%
CPM 20CV	180
14-2-4 CrMoV	145
14-4 CrMo	120
440C	100

The CATRA (Cutlery & Allied Trade Research Association) test machine measures the total number of silica impregnated cards cut in a sequence of passes along a blade. It is considered a relative measure of edge retention and wear resistance.

Crucible Industries LLC

Thermal Treatments

ANNEALING: Annealing must be performed after hot working and before rehardening.

Heat at a rate not exceeding 400°F per hour (222°C per hour) to 1860-1900°F (1016-1038°C), and hold at temperature for 1 hour per inch (25.4 mm) of maximum thickness; 2 hours minimum. Then cool slowly with the furnace at a rate not exceeding 30°F per hour (15°C per hour) to 1000°F (538°C). Continue cooling to ambient temperature in the furnace or in air. The resultant hardness should be approximately 30 HRC or lower.

HARDENING:

Preheating: Heat to 1400-1450°F (760-788°C) and equalize.

Austenitizing (High Heat): Heat rapidly from the preheat to a temperature to within 1960-2150°F (1071-1177°C). A lower austenitizing temperature will maximize impact toughness. A higher austenitizing temperature will maximize wear resistance and corrosion resistance. Soak at the austenitizing temperature for 30 minutes.

Quenching Pressurized gas or warm oil.

For pressurized gas, the furnace should have a minimum quench pressure of 4 bars. *A quench rate of approximately 400 °F (222°C) per minute to below 1000°F (538°C) is critical to obtain the desired properties.*

For oil, quench until black, about 900°F (482°C), then cool in still air to 150-125°F (66-51°C).

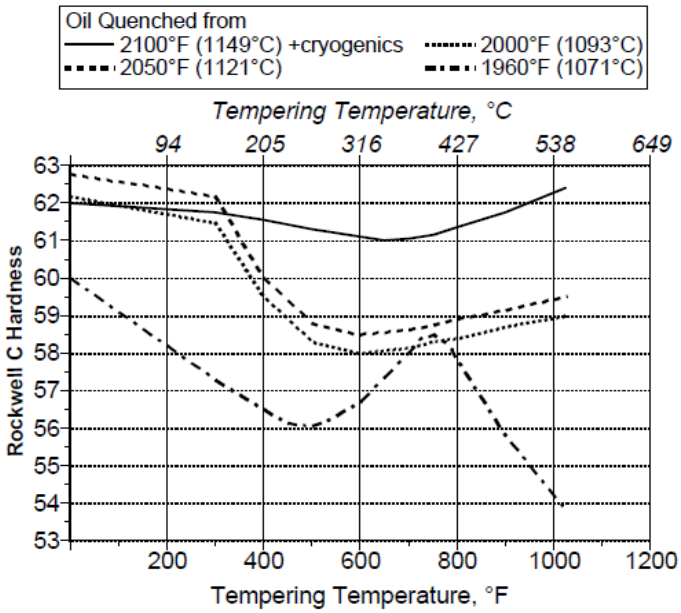
Cryogenic Treatment: For austenitizing at 2100°F (1149°C) or higher, a cryogenic treatment is recommended after quenching to 150 to 125°F (66-51°C) to reduce retained austenite. Cool to -100°F (-73°C), remove from the cooling medium, and allow part to warm to ambient temperature in still air.

Tempering: *Temper immediately after quenching, or after quenching and cryogenic treatment.*

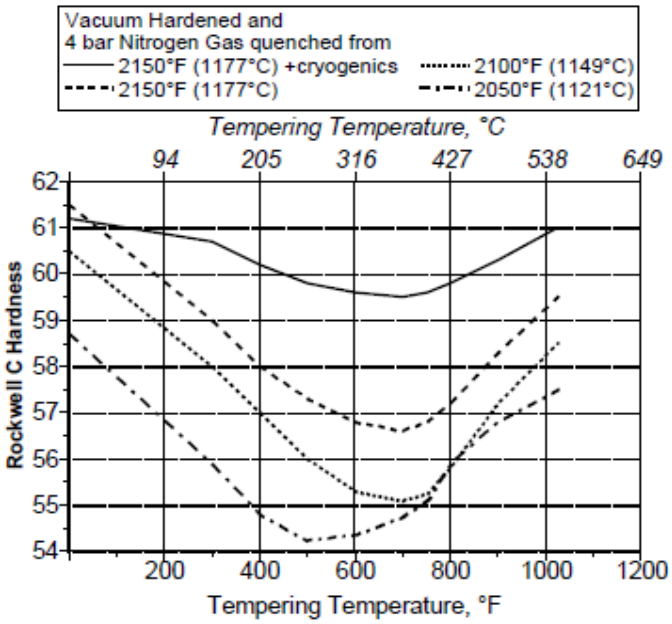
Typical temperature range is 400-800°F (204-427°C). Hold at temperature for 1 hour per inch (25.4mm) of thickness, 2 hours minimum, then air cool to ambient temperature. The typical service hardness is 56-59 HRC, although higher hardnesses may be used for increased wear resistance. *Tempering between 800 and 1100°F (427 to 583°C) will decrease corrosion resistance and toughness.*

HEAT TREATMENT RESPONSE

For Furnace or Salt Bath Hardening:



For Vacuum Furnace Hardening:



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