

CPM® 20CV

Typical Composition

C	Cr	Mo	V	W
1.90	20.00	1.00	4.00	0.60

CPM® 20CV is a unique tool steel. 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 is 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 allows for the design of more highly alloyed grades which cannot be produced by conventional steelmaking.

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 ESR)

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

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

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

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DATA SHEET

CPM® 20CV

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. Another option is subcritical anneal. Heat to 1450°F (788°C) and hold for 4 to 6 hours. Furnace cool 15°/hr to 1250°F, hold for 4 hours, then furnace cool until black (about 900°F) before pulling the hood.

Hardening

Preheat: Heat to 1400–1450°F (760–788°C) and equalize.

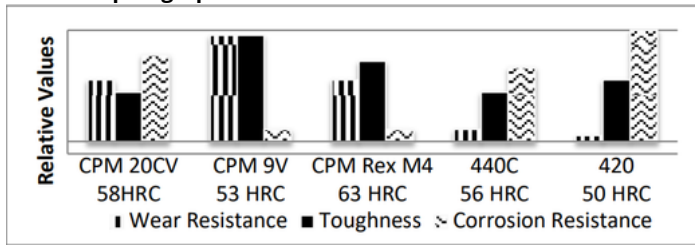
Austenitize: Heat rapidly from the preheat to a temperature to within 1960–2150°F (1071–1177°C). A lower austenitizing temperature will maximize impact toughness. A higher austenitizing temperature will maximize wear resistance and corrosion resistance. Soak at the austenitizing temperature for 30 minutes. Austenitizing between 2050°F and 2150°F should be done in a vacuum furnace.

Quench: 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).

Temper: 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 (25.4 mm) of thickness, 2 hours minimum, then air cool to ambient temperature. The typical service hardness is 56–59 HRC, although higher hardness may be used for increased wear resistance.

Tempering between 800 and 1100°F (427–583°C) will decrease corrosion resistance and toughness.

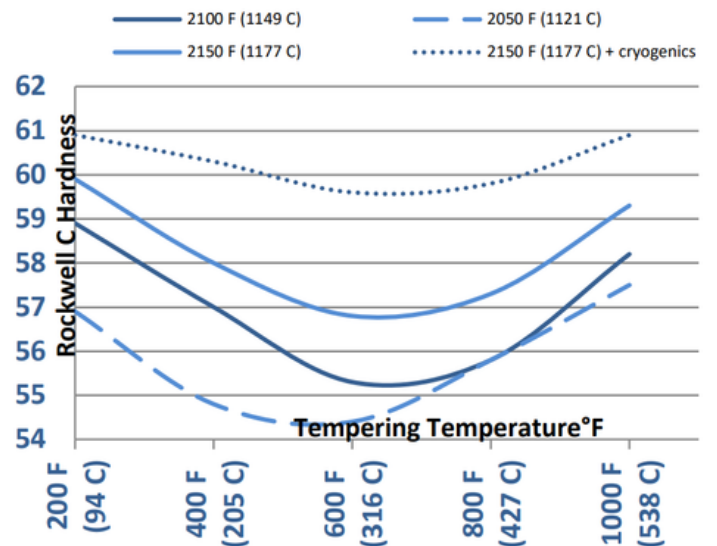
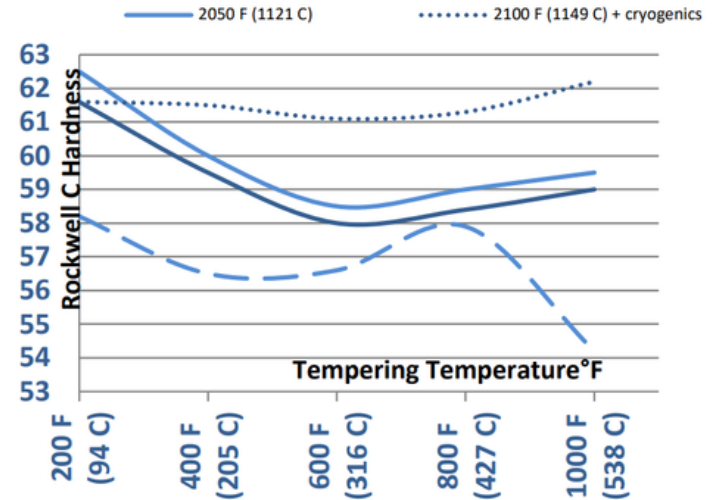
Steel Comparagraph



Heat Treatment Response

For Furnace or Salt Bath Hardening:

Oil Quenched from



Cryogenic Treating: 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.

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