Powdered Metal

from Diamond Metals Distribution

DIAMOND METALS DISTRIBUTION

Issue 2

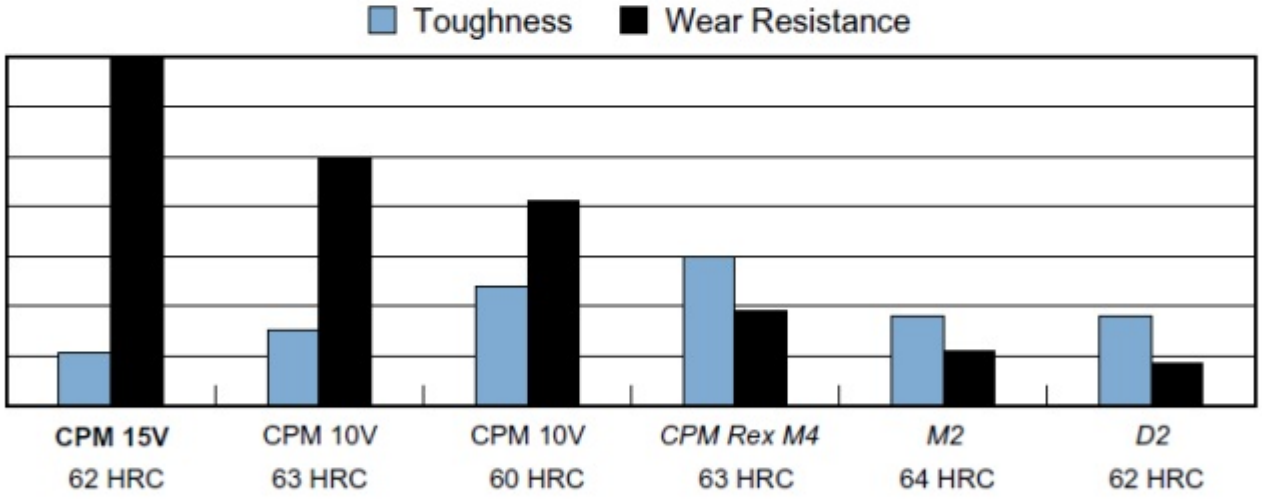
Crucible Industries CPM® 15V® Powder Metal Tool Steel

Typical Composition

C	Mn	Si	Cr	Mo	V
3.40	0.50	0.90	5.25	1.30	14.50

CPM 15V powder metal tool steel provides unmatched wear resistance for a cold work tool steel. It has more vanadium carbides in its microstructure than CPM 10V and provides more wear resistance and longer tool life in those applications where 10V has proven to be successful. CPM 15V also offers an alternative to solid carbide where carbide fails by fracture or where intricate tool design makes carbide difficult or risky to fabricate.

Relative Properties



Physical Properties

Density: 0.262 lb/in^3 (7.25 g/cm^3)
Modulus of Elasticity: 34x10^6 psi (235 GPa)

Coefficient of Thermal Expansion:

Temperature °F	in/in/ °F x 10^{-6}	Temperature °C	mm/mm/ °C x 10^{-6}
70 - 200	5.8	21 - 93	10.5
70 - 500	6.2	21 - 260	11.1
70 - 800	6.5	21 - 427	11.7
70 - 1100	6.7	21 - 593	12.1

Crucible CPM® 15V®
HEAT TREATING INSTRUCTIONS

(See Tech-Topics Bulletin 102 for a more thorough explanation of heat treating.)

CRITICAL TEMPERATURE

Ac1: 1540°F (838°C)

HARDENING:

Preheating: 1500-1550°F (816-845°C), equalize. A second pre-heat stage at 1850-1900°F (1010-1040°C) is suggested for vacuum or atmosphere hardening.

Austenitizing (High Heat): Heat rapidly from the preheat, typically by transferring to a second furnace. Furnace or Salt Bath: 1950-2150°F (1065-1175°C) Soak for 10-30 minutes at temperature.

Quenching: Air, pressurized gas, warm oil, or salt. Sections less than 3" thick may be air cooled to maximum hardness. Sections 3" thick or more must be quenched at a faster rate, using one of the methods below, to attain maximum hardness.

For pressurized gas, the furnace should have a minimum quench pressure of 4 bars. *The quench rate 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).

For salt maintained at 1000-1100°F (538-593°C), equalize in the salt, then cool in still air to 150-125°F (66-51°C).

Tempering: *Temper immediately after quenching.* Typical temperature range is 1000-1100°F (538-593°C). Do not temper below 1000°F (538°C). Hold at temperature for 2 hours then air cool to ambient temperature. Double tempering is required. Triple tempering is required when austenitized at 2100°F (1149°C) or higher.

Size Change: +0.04/0.05%

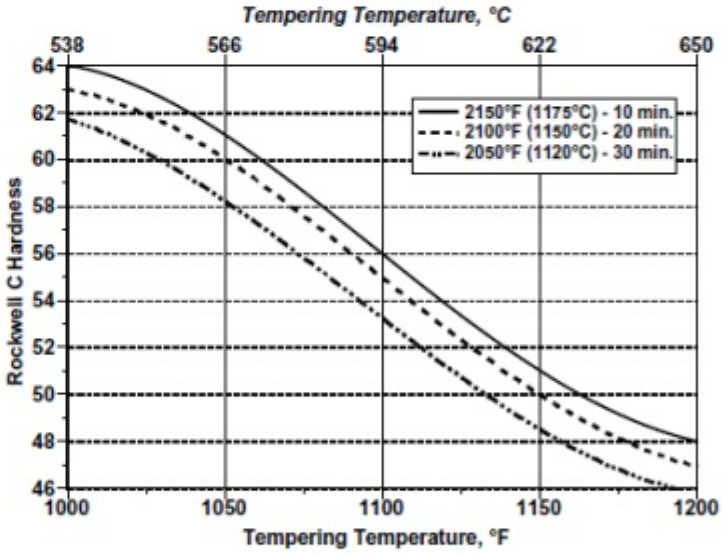
ANNEALING: Annealing must be performed after hot working and before rehardening.

Heat at a rate not exceeding 400°F per hour (222°C per hour) to 1600°F (871°C), and hold at temperature for 1 hour per inch of maximum thickness; 2 hours minimum. Then cool slowly with the furnace at a rate not exceeding 30°F per hour (17°C per hour) to 1000°F (538°C). Continue cooling to ambient temperature in the furnace or in air. The resultant hardness should be a maximum of 277 HBW.

HEAT TREATMENT RESPONSE

Hardness HRC

Tempering Temperature	Austenitizing Temperature 2050°F (1120°C)	2100°F (1150°C)	2150°F 1175°C)
1000°F (540°C)	62	63	64
Optimum Range for Wear & Toughness			
1025°F (550°C)	60	62	63
1050°F (565°C)	58	60	61
1100°F (595°C)	54	55	56
1150°F (620°C)	48	50	51
1200°F (650°C)	46	47	48
Minimum Soak	30 min	20 min	10 min
Minimum Tempers	2	2	3



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