NIAGARA SPECIALTY METALS

DATA SHEET

NSM WEAR PM

Typical Composition

C	Cr	W	Mo	V
1.15	7.5	1.0	1.6	2.4

NSM WEAR PM is an air-hardening powder metallurgy tool steel, heat treatable to HRC 60-65. The original conventionally melted CRU-WEAR® was designed as an upgrade to A2 and D2, for better wear resistance, greater toughness and higher attainable hardness. NSM WEAR PM was introduced as a way to make the conventionally melted version easier to machine and more resistant to chipping. Compared to the chemistry of D2, (D2 = 1.55% carbon, 11.5% chromium, 0.8% vanadium, and 0.9% molybdenum), NSM WEAR PM has less carbon and less chromium, but more vanadium and tungsten. The overall carbide content of NSM WEAR PM is less than D2 which helps make it tougher than D2. NSM WEAR PM's higher attainable hardness results from the fact that it contains sufficient tungsten and molybdenum to cause a secondary hardening response. Finally, NSM WEAR PM tempers at a higher range (900-1050°F) than D2 (400-600°F), so it is more compatible with a wide variety of surface treatments.

	Heat Treatment Austent. Temp.	HRC	Impact Toughness Ft.-lb	(J)	Wear Resistance Adhesive
NSM WEAR PM	1950F (1065C)	62	35	(46)	6-7
S7	1750F (955C)	57	125	(165)	1
A2	1750F (955C)	60	40	(53)	2-3
D2	1850F (1010C)	60	21	(28)	3-4
M2	2050F (1025C)	62	20	(27)	8-10

Mechanical Properties

Wear Resistance - NSM WEAR PM will offer better wear resistance than that of the AISI D2, approaching AISI M2.

Impact Toughness - NSM WEAR PM has greater toughness than the AISI D2 approaching the AISI A2.

NOTE: Lowering the hardening temperature reduces the grain size and increases toughness.

NIAGARA SPECIALTY METALS

DATA SHEET

Thermal Treatments

Annealing: Heat to 1550-1650°F (840-900°C), hold 2 hours, slow cool 50°F (25°C) per hour to 1200°F (650°C).
Annealed Hardness: About BHN 225/255

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°F (15°C) below the original tempering temperature, hold 2 hours, then furnace cool or cool in still air.

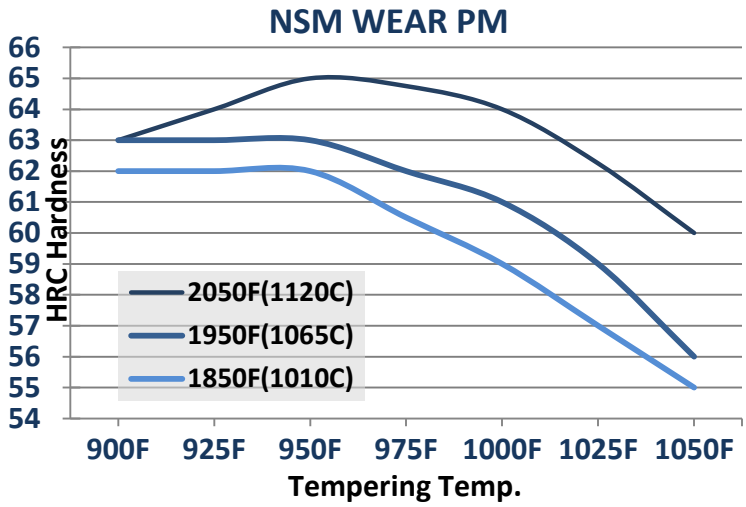
Hardening

It is customary to use two furnaces: one furnace to preheat and the second furnace to austenitize. This ensures that the transition from the pre-heat temperature to the austenitizing temperature occurs fairly rapidly.
Preheat: Heat to 1550-1600°F (840-870°C), Equalize.
Austenitize: 1850-2050°F (1010-1120°C), Hold time at temperature 20-45 minutes.
Quench: Air or positive pressure quench (2 bars minimum) to below 125°F (50°C). Salt bath treatment, if practical will ensure the maximum attainable toughness for a given hardening treatment.
Temper: 900-1050°F (480-565°C). Double tempering is mandatory, and triple tempering is recommended. Cool to room temperature in between tempers. Temper 2 hours minimum each time or at least 1 hour per inch (25mm) of thickness for sections over 2" (50mm) thick.
Size Change: Approx. +0.15%

Recommended Heat Treatment: For the best combination of toughness and wear resistance, austenitize at 1950°F (1065°C). Temper 3 times at 1000°F (540°C).

Aim hardness: HRC 62 Higher austenitizing temperatures can be used to obtain higher hardness, at a slight decrease in impact resistance. The lower austenitizing temperatures provide the best impact toughness.
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.

Tempering Temp.	1850°F (1010°C)	1950°F (1065°C)	2050°F (1120°C)
As Quenched	63-65	63-65	62-64
900°F(480°C)	61-63	62-64	61-63
950°F(510°C)	61-63	62-64	64-66
1000°F(540°C)	57-59	60-62	63-65
1025°F(550°C)	56-58	58-60	61-63
1050°F(620°C)	54-56	58-60	61-63
Minimum Time at Aust. Temp.	45 min.	30 min.	20 min.



Surface Treatments

Because of its high tempering temperatures (900-1050°F) NSM WEAR PM is suitable for nitriding, PVD coating or similar surface treatments. It will retain its hardness after such processes, making it a more suitable substrate than D2.
NOTE: CVD coating processes are generally performed at temperatures which exceed the critical temperature and may result in non-predictable dimensional distortion.

Machinability

Machinability of NSM WEAR PM in the annealed condition is similar to D2 but grindability will be slightly better. Similar grinding equipment and practices are acceptable. "SG" type alumina wheels or CBN wheels have generally given the best performance.