Technical Datasheet

CarTech® Micro-Melt® PD#5 Alloy

Type Analysis

Single figures are nominal except where noted.

Carbon	1.40 %	**Manganese**	0.30 %
Sulfur (Maximum)	0.030 %	**Silicon**	1.20 %
Chromium	7.80 %	**Molybdenum**	1.30 %
Vanadium	3.80 %	**Tungsten**	1.70 %
Iron	Balance		

General Information

Description

CarTech Micro-Melt PD#5 alloy is an air hardening cold work die steel possessing wear resistance superior to that of conventional grades such as AISI D2, while still maintaining excellent toughness. In addition, it has the compressive strength required for resistance to deformation in tooling applications. The alloy possesses a fine, uniform carbide distribution resulting from the CarTech Micro-Melt powder metal process. This uniform microstructure with fine carbide distribution is responsible for the excellent combination of wear resistance and toughness offered by this alloy.

Applications

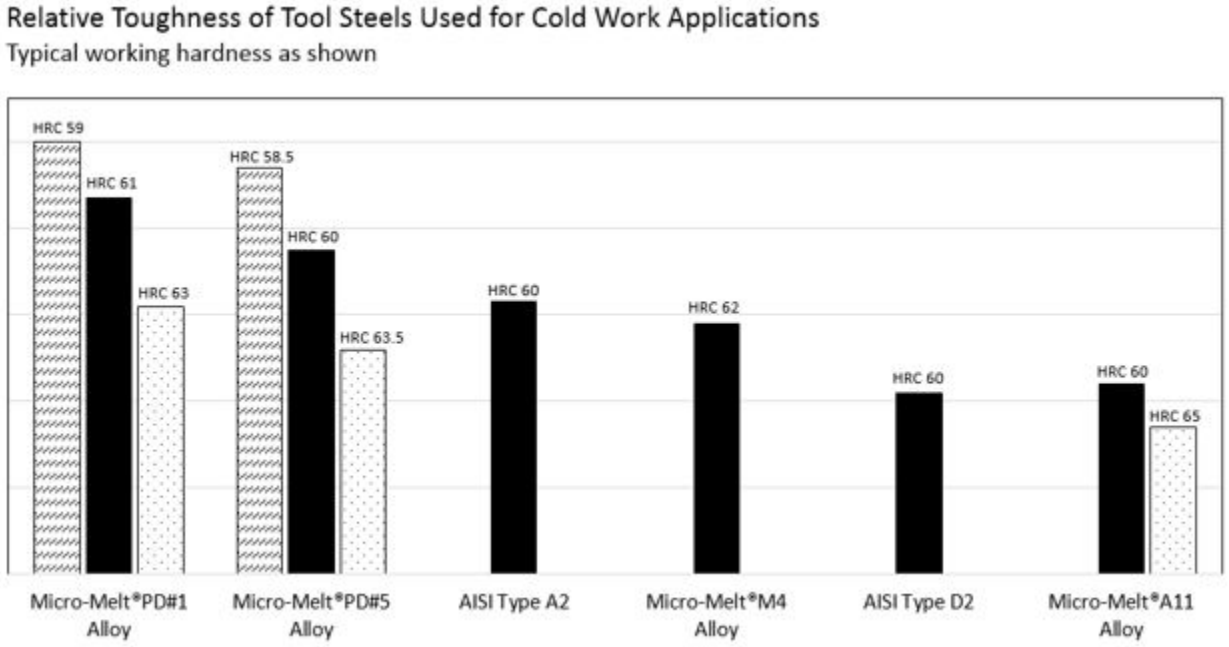
CarTech Micro-Melt PD#5 alloy may be considered for many types of cold work tooling applications where a combination of excellent wear resistance and good toughness is required. Potential applications for this alloy may include: punches, rotary shears, blanking dies, chipper knives, slitter knives, thread rolling dies.

Properties

Physical Properties

Density	0.2770	lb/in³
Modulus of Elasticity (E)	30.0	x 10 ³ ksi

Typical Mechanical Properties



Heat Treatment

Decarburization

CarTech Micro-Melt PD#5 alloy, like all carbon-bearing tool steels, is subject to decarburization during thermal processing. However, taking proper precautions should insure that there is no decarburization during heat treatment. salt bath, controlled atmosphere, or vacuum furnaces are acceptable for heat treating this alloy.

Normalizing

Normalizing is not recommended for this alloy.

Annealing

Suitable precautions should be taken to prevent excessive decarburization or carburization. Heat slowly to 1550/1600°F (843/871°C), hold until the entire mass is heated through, and cool slowly (do not exceed 30°F [15°C] per hour) in the furnace to about 1000°F (538°C), after which the cooling rate may be increased.

The annealed hardness should be maximum 255 HBW (25.5 HRC).

Hardening

CarTech Micro-Melt PD#5 Alloy can be heat treated in salt, vacuum, or controlled atmosphere furnaces, with precautions being taken to avoid decarburization during the heat treatment operation. Preheat to 1550/1600°F (843/871°C), then transfer to 1850/2100°F (1010/1149°C). Hold 20 - 45 minutes at temperature. Following austenitizing, parts may be air cooled to room temperature. For vacuum furnace treating, a minimum 2 bar backfill with inert gas is desired for the quench.

Stress Relieving

To relieve the stresses of machining, heat slowly to 1200/1250°F (649/677°C), hold for a minimum of 1 hour at temperature, cool slowly and uniformly to about 800°F (427°C), then cool in still air.

Tempering

Tools should be tempered immediately after the completion of the quench. Triple tempering at 2 hours per temper is suggested, using a minimum tempering temperature of 950°F (510°C). Tools should be cooled to room temperature between tempers.

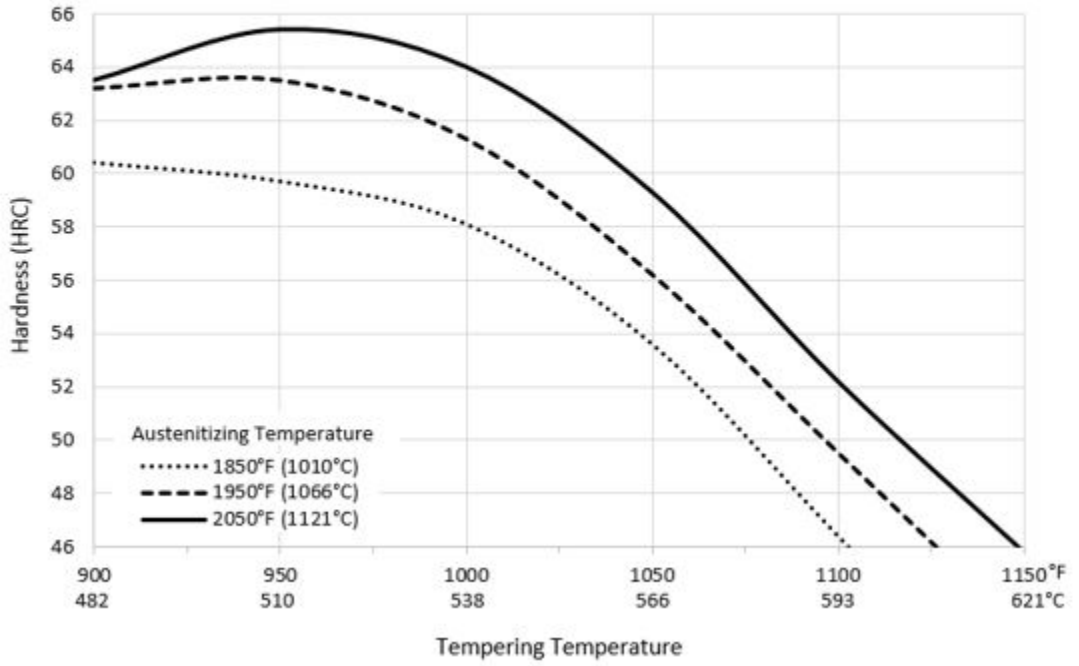
Effect of Hardening and Tempering Temperatures on Hardness -
Carpenter Micro-Melt PD#5 Alloy

All samples were austenitized for the indicated time and temperature in a neutral salt, air cooled to room temperature and then tempered at the indicated temperature for 2+2+2 hours followed by air cooling. Vacuum hardening may result in slightly lower hardness values.

Tempering Temperature		Austenitizing Temperature					
		1850°F	1900°F	1950°F	2000°F	2050°F	2100°F
°F	°C	1010°C	1038°C	1066°C	1093°C	1121°C	1149°C
As Quenched		60.5	63.0	64.5	65.0	64.5	64.5
900	482	60.5	62.5	63.0	63.5	63.5	63.5
950	510	59.5	62.0	63.5	64.5	65.5	66.0
1000	538	58.0	60.5	61.5	62.5	64.0	64.5
1050	566	53.5	55.0	56.0	57.5	59.5	60.0
1100	593	46.5	48.0	49.5	51.0	52.0	53.0
1150	621	39.0	41.0	43.0	44.5	46.0	46.5
Austenitizing Time		45 minutes		30 minutes		20 minutes	

Effect of Hardening and Tempering Temperatures on Hardness - Carpenter Micro-Melt PD#5 Alloy

All samples were austenitized at the indicated temperature in a neutral salt, air cooled to room temperature and then tempered at the indicated temperature for 2+2+2 hours followed by air cooling.



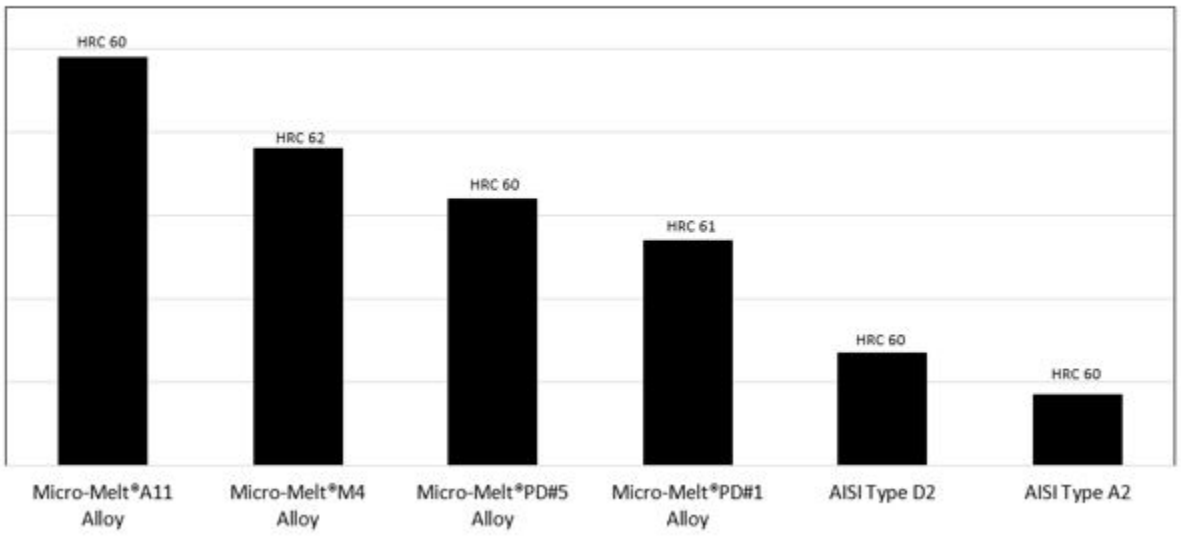
Other Information

Wear Resistance

The relative wear resistance of CarTech Micro-Melt PD#5 alloy compared to other tool steels which have been used for cold work applications is shown in the figure entitled “Relative Wear Resistance of Tool Steels Used for Cold Work Applications.” Wear resistance was measured using a Dry Sand/Rubber Wheel abrasion test, ASTM G65. Results were normalized, with a higher value indicating better wear resistance.

Relative Wear Resistance of Tool Steels Used for Cold Work Applications

Typical working hardness as shown



Forms Manufactured

- Bar-Flats
- Bar-Squares
- Plate
- Slabs
- Bar-Rounds
- Billet
- Powder

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