Technical Datasheet

CarTech® Micro-Melt® M42 Alloy

Identification

UNS Number

• T11342

AISI Number

• Type M42

Type Analysis

Single figures are nominal except where noted.

Carbon	1.10 %	**Manganese**	0.30 %
Sulfur	0.060 %	**Silicon**	0.60 %
Chromium	3.75 %	**Molybdenum**	9.50 %
Cobalt	8.25 %	**Vanadium**	1.15 %
Tungsten	1.50 %	**Iron**	Balance

General Information

Description

CarTech Micro-Melt M42 alloy is a powder metal super-high-speed steel possessing a hardness capability of Rockwell C 68/70. This alloy has been used for cutting tools in the toughest machining operations.

The advantages of CarTech Micro-Melt premium powder high speed steel include ease of grinding, response to heat treatment, more uniform structure, greater wear resistance and improved toughness.

In addition, Carpenter's unique hot rolling and rotary forging capabilities impart minimal distortion characteristics to these alloys.

Applications

Tooling applications for CarTech Micro-Melt M42 alloy have included:

Twist drills
Turning tools
End mills
Milling cutters
Broaches
Router bits
Form tools
Keyway cutters
Dovetail tools
Flycutters
Thread rolling dies
Tool bits

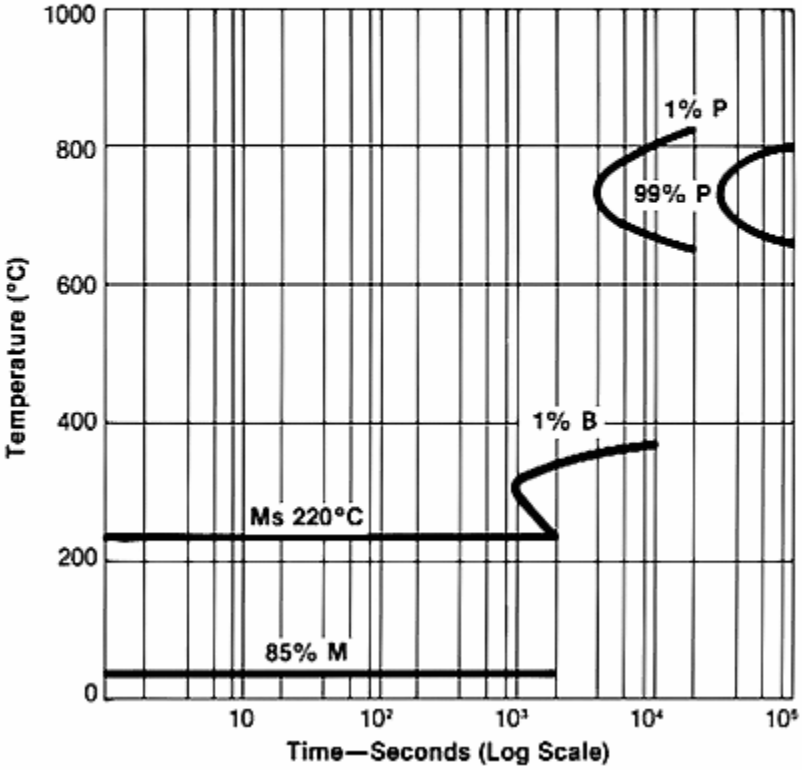
Properties

Physical Properties

Specific Gravity	7.98	
Density	0.2880	lb/in³
Modulus of Elasticity (E)	30.0	x 10 ³ ksi

Specific gravity	7.98
Density	
lb/cu in	0.288
kg/cu m	7980
Modulus of elasticity	
psi x 10^6	30

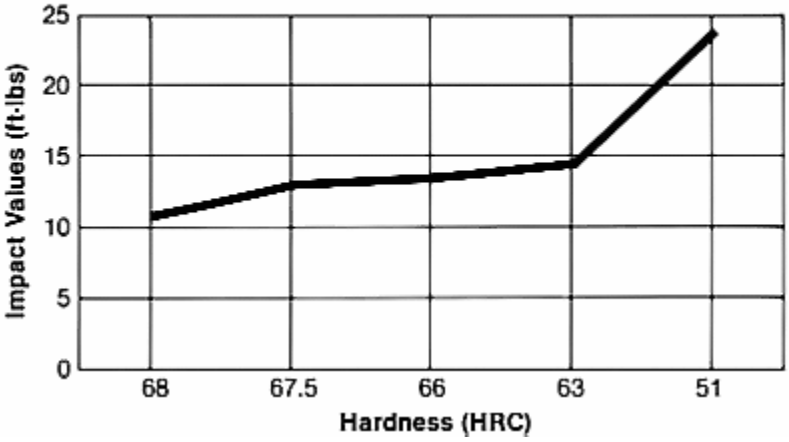
Isothermal transformation diagram—Carpenter Micro-Melt M-42 Alloy
Austenitized 1225°C.



Typical Mechanical Properties

The determination of accurate, meaningful mechanical properties on high-strength, notch-sensitive materials is extremely difficult. Nevertheless, the following graph gives some idea as to the toughness of Micro-Melt M42 alloy.

Unnotched Izod Impact Values—Carpenter Micro-Melt M-42 Alloy
All specimens were austenitized at 2150°F (1193°C) in salt for 5 minutes at heat, oil quenched, tempered 2H + 2H + 2H to hardness and air cooled.



Heat Treatment

Decarburization

Micro-Melt M42 alloy is more susceptible to decarburization than tungsten-type high speed steels. Methods for preventing decarburization in molybdenum-type high speed steels are well known. If proper controls are maintained, this alloy will present no difficulty with decarburization.

Normalizing

Normalizing is not recommended.

Annealing

Suitable precautions should be taken to prevent excessive carburization or decarburization.
Heat slowly to 1550/1650°F (843/899°C), hold until the entire mass is heated through, and cool slowly (do not exceed 20°F [11°C] per hour) in the furnace to about 1000°F (538°C), after which the cooling rate may be increased.

The expected hardness following this treatment is Brinell 235/269.

Hardening

For best results Micro-Melt M42 alloy should be heat treated from properly rectified salt baths or controlled atmosphere furnaces.

Preheat to 1500/1600°F (816/871°C) in a neutral salt bath. After thorough preheating, transfer to a salt bath with a temperature maintained at 2150/2200°F (1177/1204°C) and oil quench.

Small sizes under about 1" (25.4 mm) in diameter or delicate sections may be hardened by cooling in still air. It is also acceptable to quench in molten salt at temperatures of 1000/1100°F (538/593°C), equalizing for 5 minutes per inch followed by air cooling.

Stress Relieving

To relieve the strains of machining, heat slowly to 1150/1250°F (621/677°C), allow to equalize, then cool in still air.

Tempering

Tools should be tempered immediately after the completion of the quench.

The tempering temperature may be varied according to the desired hardness but is usually in the range of 1000/1050°F (538/566°C).

Triple tempering is always suggested.

The effects of various tempering temperatures on Rockwell hardness are shown in the following chart.

Effect of Tempering Temperature on Hardness—Carpenter Micro-Melt M-42 Alloy
All specimens were oil quenched and triple tempered at 2 hours + 2 hours + 2 hours and air cooled.

Tempering Temperature		Rockwell C Hardness Quenched from 2200°F (1204°C)
°F	°C	
As Quenched		64/66
300	149	63/65
500	260	62/64
700	371	62/64
900	482	66/68
950	510	68/70
1000	538	67/69
1050	566	66/68
1100	593	65/67

Workability

Forging

Preheat slowly to 1400/1500°F (760°/816°C), allow plenty of time for heat equalization, then raise the temperature slowly to 2050°F (1121°C), soak, and forge at this temperature.

Do not forge under 1800°F (982°C); reheat as often as necessary.

Small forgings may be cooled slowly in vermiculite.

The best practice for large forgings is to place them in a furnace heated to about 1400/1450°F (760/788°C), soak uniformly at this heat, then shut off the heat and let the forgings cool in the furnace. This is not an anneal. When the forgings are cool, they should be properly annealed.

Other Information

Forms Manufactured

- Bar-Flats
- Bar-Squares
- HIP'd Shapes
- Wire
- Bar-Rounds
- Billet
- Powder

Technical Articles

- New Ideas for Machining Austenitic Stainless Steels
- New Powder Metal Alloy Bridges Gap Between High Speed Steel and Tungsten Carbide

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