Technical Datasheet

CarTech® Micro-Melt® M48 Alloy

Identification

UNS Number

• T11348

AISI Number

• Type M48

Type Analysis

Single figures are nominal except where noted.

Carbon	1.55 %	**Sulfur**	0.070 %
Chromium	4.00 %	**Molybdenum**	5.25 %
Cobalt	9.00 %	**Vanadium**	3.10 %
Tungsten	10.00 %	**Iron**	Balance

In addition, the alloy can be produced with increased sulfur levels, up to 0.30%, for tools requiring improved machinability.

General Information

(Equivalent in hardness, heat treating response, toughness, and wear resistance to CPM* REX* 76)

* CPM and REX are trademarks of Crucible Materials Corporation.

Description

CarTech Micro-Melt M48 alloy is a super high speed steel possessing abrasion resistance equal to T15 and superior red hardness to T15 and M42. It is heat treatable to HRC 70 and is a good candidate for special purpose cutting tools where other ASTM M40 series high speed steels are inadequate

CarTech Micro-Melt M48 alloy is suggested for use where high red hardness, high abrasion resistance, and good toughness are required.

The advantages of CarTech Micro-Melt powder high speed steels 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

CarTech Micro-Melt M48 alloy has found applications in tools such as:
milling cutters
form tools
end mills
broaches
cutting tool inserts
reamers
extrusion die inserts
cut-off tools
lathe tools

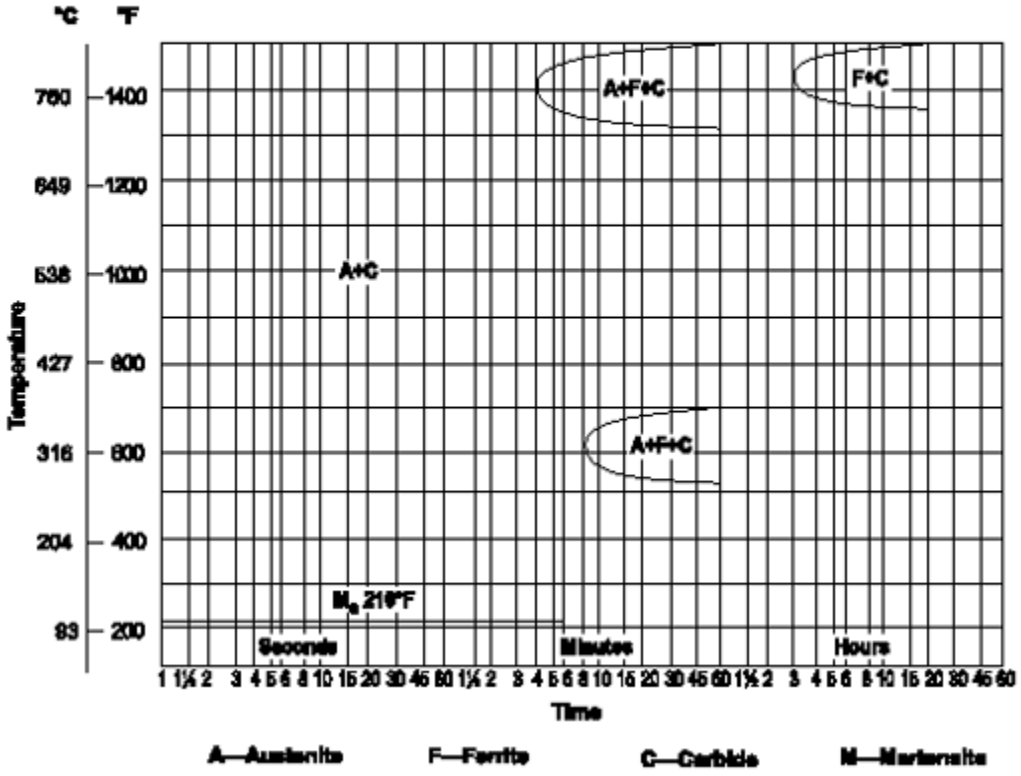
Properties

Physical Properties

Specific Gravity	8.26	
Density	0.2980	lb/in³
Modulus of Elasticity (E)	31.0	x 10 ³ ksi

Isothermal transformation diagram—Carpenter Micro-Melt M48 Alloy

Austenitizing temperature—2175°F (1191°C).
Critical (A_1) temperature—1535°F (835°C).
Prior condition—annealed.



Critical Temperature (AC1)	1535 °F
Martensite Start	210 °F

Typical Mechanical Properties

Hardness Results—Carpenter Micro-Melt M48 Alloy

Typical HRC values for samples preheated at 1550°F (843°C), austenitized in a salt bath for 3 minutes at temperature, oil quenched, and triple tempered (2 + 2 + 2 hours) at indicated temperature. Vacuum hardening may result in slightly lower hardness values.

Tempering Temperature		Austenitizing Temperature, Salt Bath	
°F	°C	2125°F (1163°C)	2175°F (1191°C)
As-Quenched		62/64	60/62
1000	538	68/70	68/70
1025	552	66/68	67/69
1050	566	65/67	66/68
1100	593	64/66	65/67
1150	621	60/62	61/63
1200	649	53/55	56/58

Heat Treatment

Decarburization

Micro-Melt M48 alloy is somewhat susceptible to decarburization in hardening. Means of preventing this are well known. If proper control of atmosphere is maintained, this alloy will present no difficulty with decarburization.

Annealing

Micro-Melt M48 alloy must be fully annealed after forging and before hardening. For full annealing, heat uniformly to 1600°F (871°C), hold at temperature for two hours, cool slowly at 25°F (14°C) per hour maximum in the furnace to below 1000°F (538°C), and air cool to room temperature. The full annealed hardness will be 285/311 BHN.

Hardening

It is customary to use two furnaces to harden Micro-Melt M48 alloy. One furnace is used to preheat the workpiece to 1500/1550°F (816/843°C), and the second is used to rapidly heat the workpiece from the preheating temperature to the hardening temperature of 2100/2200°F (1149/1204°C). Typical soak times are 2-3 minutes at the high temperature.

Quenching

Quench in oil or a salt bath maintained at 1000/1100°F (538/593°C).

An interrupted quench is recommended when oil quenching is used, particularly for workpieces of large section or complicated design. The workpiece should be quenched in oil until it has reached approximately 1000/1100°F (538/593°C) (dull red color), removed from the oil and allowed to air cool to below 150°F (66°C), or until the work-piece can be touched comfortably with a bare hand.

When a salt bath is used, the workpiece is quenched into the bath and held long enough to cool to the bath temperature. It is then removed from the bath and allowed to air cool to below 150°F (66°C), or until it can be touched comfortably with a bare hand.

Salt bath quenching of large sections may result in slightly lower hardness than an interrupted oil quench.

Straightening

Any necessary straightening should be done from the quench at any temperature down to 800°F (427°C).

Stress Relieving

To relieve the stresses of machining, heat slowly to 1150/1250°F (621/677°C), hold 1 to 2 hours, then cool in still air.

Tempering

Tempering should be performed immediately after quenching and cooling of the workpiece below 150°F (66°C), or as soon as it can be touched comfortably with a bare hand. The tempering temperature may be varied depending upon the application and desired hardness. Triple tempering is required and four tempers are desirable. Typical tempering is performed at 1000°F (538°C) for two hours at temperature followed by air cooling to room temperature. This cycle is repeated twice to obtain triple tempering.

Workability

Forging

Heat slowly and uniformly to 2025/2075°F (1107/1135°C) and equalize to furnace temperature. Reheat if workpiece temperature falls below 1700°F (927°C). After forging, slow cool the workpiece in an insulating medium to room temperature followed by subcritical annealing, or subcritically anneal the hot workpiece after forging. Subsequent full annealing of the workpiece should be done prior to hardening.

Other Information

Forms Manufactured

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

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