Technical Datasheet

CarTech® Micro-Melt® HS30 Alloy

Type Analysis

Single figures are nominal except where noted.

Carbon	1.27 %	**Manganese**	0.30 %
Phosphorus (Maximum)	0.030 %	**Sulfur (Maximum)**	0.030 %
Silicon	0.55 %	**Chromium**	4.20 %
Molybdenum	5.00 %	**Cobalt**	8.50 %
Vanadium	3.10 %	**Tungsten**	6.25 %
Iron	Balance		

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

General Information

Description

CarTech Micro-Melt HS30 alloy is an 8% cobalt, high hardenability tungsten-molybdenum alloyed high speed steel exhibiting excellent hot hardness combined with good wear resistance and toughness. It is recommended for cutting tools for difficult-to-machine materials and high cutting speeds.

The advantages of Carpenter CarTech Micro-Melt premium 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 HS30 alloy should be considered for use in tools including:

Milling cutters
End mills
Cutting tool inserts
Gear cutting tools
Lathe tools
Punches and dies
Form tools
Broaches
Reamers
Cut-off tools
Drills
Taps

Properties

Physical Properties

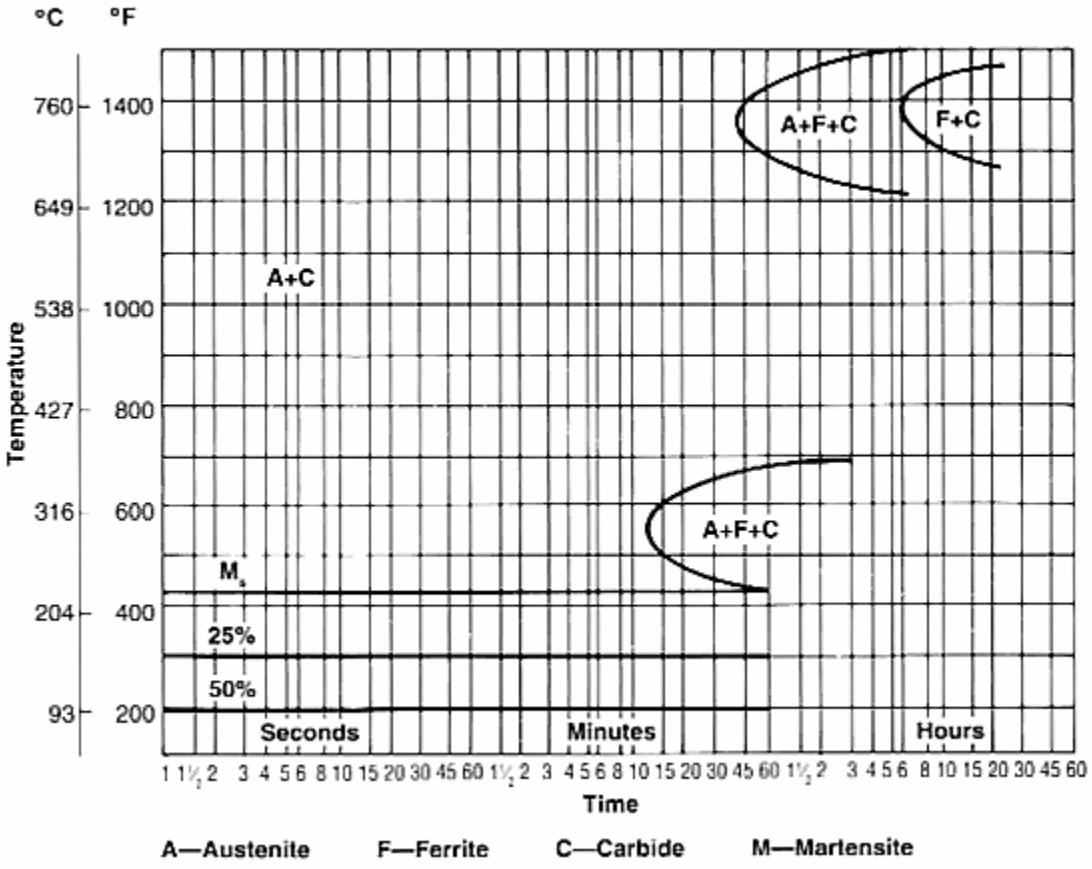
Specific Gravity	8.23	
Density	0.2970	lb/in³
Mean Specific Heat	0.1000	Btu/lb/°F
Mean CTE		
68 to 212°F	6.60	x 10 $^{-6}$ in/in/°F
68 to 500°F	6.80	x 10 $^{-6}$ in/in/°F
68 to 800°F	7.20	x 10 $^{-6}$ in/in/°F
68 to 1200°F	7.50	x 10 $^{-6}$ in/in/°F

Mean coefficient of thermal expansion

Temperature		Coefficient	
From 68°F to	From 20°C to	x 10^{-6}/°F	x 10^{-6}/K
212	100	6.6	11.88
500	260	6.8	12.24
800	427	7.2	12.96
1200	649	7.5	13.50

Modulus of Elasticity (E)	30.0 x 10^3	ksi
Modulus of Rigidity (G)	12.0 x 10^3	ksi

Isothermal transformation diagram - Carpenter Micro-Melt HS-30 Alloy
Austenitizing temperature - 2190°F (1199°C).
Prior condition - annealed.



Critical Temperature (AC1)	1535	°F
Martensite Start	420	°F

Heat Treatment

Decarburization

Micro-Melt HS30 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 HS30 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 255/285 BHN.

Hardening

It is customary to use two furnaces to harden Micro-Melt HS30 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 2125/2200°F (1163/1204°C) for atmosphere furnaces or 2100/2175°F (1149/1191°C) for salt baths.

Metal cutting tools are usually hardened from the high side of the hardening temperature range, i.e. 2155/2175°F (1179/1191°C) in salt, while cold work tools (punches and dies) are hardened from the low side of the hardening range. Typical soak times at the hardening temperature are 3-5 minutes.

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 sections 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 workpiece 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 generally results 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).

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 on the application and desired hardness.

Triple tempering is required. Typical tempering is performed at 1025°F (552°C) for two hours at temperature followed by air cooling to room temperature. This cycle is repeated twice to obtain triple tempering.

Tempering below 1000°F (538°C) is not recommended.

Effect of Hardening and Tempering Temperature on Hardness — Carpenter Micro-Melt HS-30 Alloy

Typical HRC values for material austenitized in a salt bath for two minutes at temperature, oil quenched, and triple tempered 2+2+2 hours at indicated temperature.

Tempering Temperature		Austenitizing Temperature, Salt Bath		
°F	°C	2100°F (1149°C)	2155°F (1179°C)	2175°F (1191°C)
As Quenched		64/66	64/66	64/66
1000	538	65/67	65/67	66/68
1025	552	64/66	65/67	65/67
1050	566	63/65	64/66	65/67
1100	593	62/64	63/65	64/66
1150	621	58/60	60/62	62/64

Workability

Forging

Heat slowly and uniformly to 1950/2050°F (1066/1121°C) and equalize to furnace temperature. Reheat if workpiece temperature falls below 1700°F (927°C). After forging, slow cool workpiece in mica to nominally room temperature followed by subcritical annealing or subcritically anneal the hot workpiece after forging.

Subsequent full annealing of workpiece should occur prior to hardening.

Other Information

Forms Manufactured

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

Technical Articles

- A New Guide for Selecting Ferrous Alloys, Tungsten Carbides and Ceramics for Tooling

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