CARPENTER
Powder Products

Metal Injection Molding (MIM)

The Metal Injection Molding (MIM) process uses UltraFine® powders and plastic binders to cost effectively produce small, complex parts for a wide variety of applications including: aerospace, automotive, consumer goods, dental tools, firearms, and medical devices.

MIM results in net shape parts with mechanical properties nearly equivalent to cast and wrought products and allows high production rates while holding strict dimensional tolerances.

Ready to Meet Your Needs

A pioneer in the development and production of metal powders, CPP offers a tremendous variety of alloys covering nearly every application. Great pride is taken in our ability to control the alloy's chemistry and particle size to meet customers' stringent requirements. Superb consistency is provided within and between production lots.

Being the only major powder metals manufacturer with production facilities in both North America and Europe enables CPP to supply customers in a timely and cost effective manner. Currently in place are one 450 kg and two 1000 kg furnaces in Bridgeville, PA, USA, a 1200 kg furnace in Woonsocket, RI, USA and twin 5500 kg furnaces in Torshalla, Sweden. This is one of the largest capacities for gas atomized powder available from any manufacturer. Extensive research and development capabilities are available for developing new alloys to meet our customers' needs including a 150 kg furnace in Reading, PA, USA. Facilities include cover gas, vacuum, and air induction melt furnaces which are capable of using a variety of gasses for atomization depending upon the alloy being produced. Certifications include ISO9001, AS9100, and NADCAP.

Producing metal powders for over 40 years, CPP has hundreds of years of combined experience and is committed to continuous manufacturing improvement. Strategic relationships are often initiated with customers to develop and supply new powder metal alloys in the exact specification which best suits the requirements of their application.

Standard UltraFine® Powders

Stainless Alloys	303L, 304L, 310, 314, 316L, 321, 347, 410L, 410C, 420, 430L, 430C, 440C, 13-8, 17-4, HK-30
Tool Steels	M-2, M-4, D-2, H-11, H-13, S-7, T-15, T-42, 420 CW
Magnetic Alloys	Fe2%Ni, Fe8%Ni, Fe30%Ni, Fe6%Si, Fe17%Si, Fe9%Si6%Al, Fe10%Al, Fe50%Co, Fe49%Co2%V, ASTM F15
SuperAlloys	100, 230, C276, 625, 718
Master Alloys	316L MA, 17-4 PH MA

This is only a partial list of available alloys.

Standard Powder Fractions

D90<5µ, D90<10µ, D90<16µ, D90<22µ, D90<30µ, D90<35µ; D85<16µ, D85<22µ, D85<31µ; D80<16µ, D80<22µ

Other fractions available upon request.

Particle sizes and distributions are measured / determined by laser diffraction method, (Microtrac).

Standard Packaging

PE Bottles	5 kg	10 lbs
PE Pails	25 kg	50 lbs
Drums	250 kg	500 lbs

Other packages available upon request.

Metal Injection Molding Powders

UltraFine®	Nominal Chemical Composition (typical values in wt.%)								UNS No.
	C	Cr	Ni	Mo	Si	Mn	Fe	Others	
410	≤0.15	11.5-13.5	—	—	≤1.0	≤1.0	Bal	—	S41000
420	0.40-0.45	12.0-14.0	—	—	≤1.0	≤1.0	Bal	—	S42080
430L	≤0.03	16.0-18.0	—	—	≤1.0	≤1.0	Bal	—	—
440C	1.00-1.15	18.0	—	—	≤1.0	≤1.0	Bal	—	S44004
304L	≤0.03	18.0-20.0	8.0-12.0	—	≤1.0	≤2.0	Bal	—	S30403
314	≤0.25	23.0-26.0	19.0-22.0	≤0.50	1.5-3.0	≤2.0	Bal	—	S31400
316L	≤0.03	16.6-17.1	10.3-10.7	2.06-2.26	0.4-0.6	1.2-1.5	Bal	—	S31683
316L 3X MA	≤0.03	51.6-53.4	37.0-39.0	6.6-7.9	≤1.0	≤0.5	Bal	—	—
347	0.04-0.08	17.0-19.0	9.0-13.0	≤0.75	≤1.0	≤2.0	Bal	—	S34700
17-4	≤0.07	15.5-17.5	3.5-4.5	—	≤0.5	≤0.5	Bal	**Cu:** 3.5-4.5, **Nb:** 0.15-0.45	S17400
17-4 3X MA	≤0.04	46.5-51.5	9.0-15.0	—	≤2.4	≤3.0	Bal	**Cu:** 9.0-15.0, **Nb:** 0.95-1.35	—
D2	1.40-1.60	11.0-13.0	—	0.7-1.2	≤0.6	≤0.6	Bal	**Co:** ≤1.0, **V:** ≤1.10	T30402
M2	0.78-1.05	3.75-4.5	—	4.5-5.5	0.2-0.45	0.15-0.4	Bal	**W:** 5.5-6.75, **V:** 1.75-2.20	T11302
M4	1.35	4.3	—	4.7	0.4	0.3	Bal	**W:** 5.6, **V:** 4.1	T11304
T15	1.50-1.60	3.75-5.0	—	≤1.0	0.15-0.4	0.15-0.4	Bal	**W:** 11.75-13.0, **Co:** 4.75-5.25, **V:** 4.5-5.25	T12015
H13	0.4	5.1	—	1.3	1.0	0.35	Bal	**V:** 1.0	T20813
F15	≤0.04	≤0.20	27.0-31.0	≤0.20	≤0.20	≤0.5	Bal	**Co:** 15-19	K94610
4340	0.38-0.43	0.7-0.9	1.65-2.0	0.2-0.3	0.15-0.30	0.6-0.8	Bal	—	G43400
CoNiCrAlY	≤0.03	20.0-22.0	31.0-33.0	—	—	—	≤0.5	**Y:** 0.35-0.6, **Al:** 7.0-9.0, **Co:** Bal	—
Cu-MIM	—	—	—	—	—	—	≤0.10	**Cu:** Bal	—
Fe2Ni	≤0.03	—	1.5-2.5	—	≤1.0	≤1.0	Bal	—	—
Fe8Ni	≤0.03	—	7.5-8.5	—	≤1.0	≤1.0	Bal	—	—
Fe30Ni	≤0.03	—	29.0-31.0	—	≤1.0	≤1.0	Bal	—	—
Fe30Ni6Mn	≤0.4	—	30.0-30.5	—	≤0.1	4.5-5.6	Bal	**Al:** 0.05-0.10	—
Fe8Cr	≤0.03	7.5-8.5	—	0.2-0.5	0.3-1.0	0.2-0.8	Bal	—	—
FeCoV	Report	—	≤1.0	—	≤1.0	—	Bal	**V:** 1.0-3.0, **Co:** 48.0-50.0	—
FeCrAlY	≤0.08	22.0-23.0	—	—	≤1.0	≤1.0	Bal	**Al:** 6.0-7.0, **Y:** Bal	—
FeSiAl	≤0.02	—	—	—	8.0-10.0	—	Bal	**Al:** 5.0-7.0	—
HK30	0.40-0.50	23.0-27.0	19.0-22.0	≤0.5	0.75-1.75	≤1.5	Bal	**Nb:** 1.20-1.50, **V:** ≤0.20, **W:** ≤0.20, **Sn:** ≤0.20	J94203
Alloy 718	0.02-0.08	17.0-21.0	Bal	2.8-3.3	≤0.35	≤0.35	≤19.0	**Al:** 0.3-0.7, **Nb:** 4.75-5.5, **Ti:** 0.65-1.15, **Co:** ≤0.3	N07718
NiCoCrAlY	≤0.03	15.0-19.0	Bal	—	—	—	—	**Co:** 20.0-26.0, **Al:** 12.0-14.0, **Y:** 0.35-0.65	—
Alloy N 90	≤0.13	18.0-21.0	Bal	—	≤0.3	≤0.3	≤1.0	**Co:** 15.0-21.0, **Ti:** 2.0-3.0, **Al:** 1.0-2.0	—
SCM440	0.38-0.43	0.9-1.2	≤0.25	0.15-0.30	0.15-0.35	0.6-0.85	Bal	**Cu:** ≤0.3	—

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CARPENTER
Powder Products

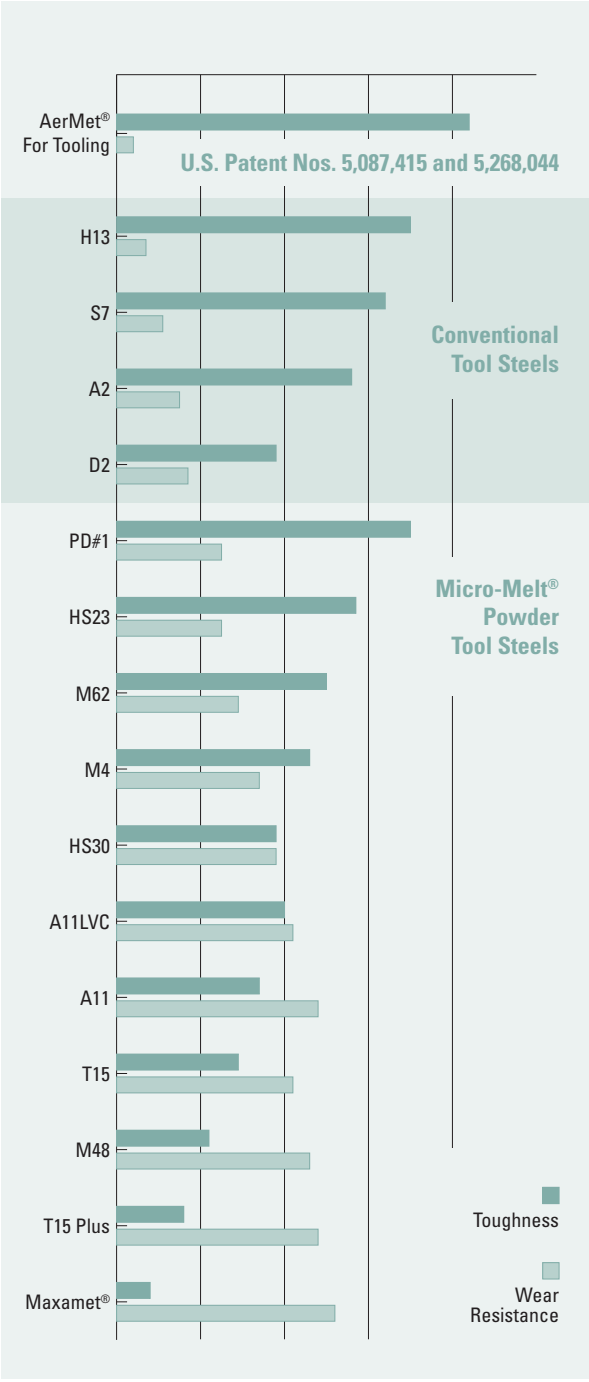
Micro-Melt® Powder Tool Steels

Micro-Melt® powder tool steel alloys are available as powders, hot isostatically pressed (HIP'd) shapes, and hot/cold worked mill form products (billet, bar, wire, plate, and sheet). Traditional cast/wrought alloys are also available, including AerMet® for Tooling and Pyrotool® 7 alloys among others.

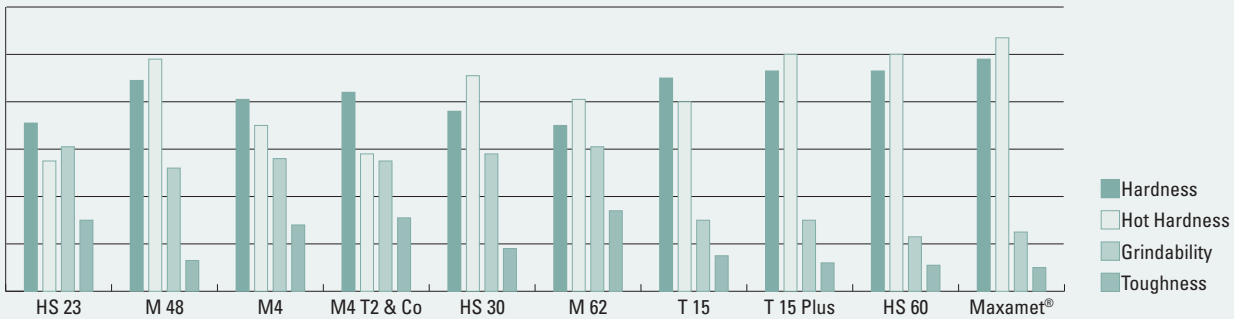
CPP is a pioneer in the development and production of metal powders, having produced powders for over 40 years and with hundreds of years of combined experience. Being the only P/M manufacturer with production facilities in both North America and Europe enables us to supply customers in a timely and cost-effective manner. These facilities include cover gas, vacuum, and air induction melt furnaces which are capable of using a variety of gasses for atomization, depending upon the alloy being produced. Micro-Melt alloys offer a homogeneous, fine, and super clean microstructure, providing the following benefits to the tool maker and end-user over traditionally cast/wrought products:

- Improved machinability in the annealed condition
- Improved grindability in the hardened and tempered condition
- Improved toughness
- Improved cutting performance
- Improved wear resistance
- Improved corrosion resistance
- Improved heat-treat response
- Increased tool life

Tool steel comparative properties: toughness and wear resistance



Micro-Melt Powder High-Speed Steels Comparative Properties



Nominal Chemistries, Applications, and Comparable Alloys (additional alloys are available)

Micro-Melt®	Nominal Chemical Composition (Typ. Wt. %)						International Codes			Alloy Type and Typical Application
	C	Cr	Mo	W	Co	V	UNS	W Nr	AISI	
HS-23	1.20	4.00	4.90	6.20	—	2.90	T 11323	1.3344	—	High-speed steels, hobs, punches, taps, drills, slitter knives, milling cutters, rolls, broaches, end mills, insert heading dies, dovetail tools, molds, keyway cutters, reamers, and thread roll dies.
M4	1.35	4.30	5.00	5.60	—	4.10	T 11304	—	M4	
HS-30	1.30	4.20	5.10	6.40	8.50	3.20	—	1.3207	—	
M62	1.30	3.75	10.50	6.25	—	2.00	T 11362	—	M62	
T15	1.55	4.00	—	12.00	5.00	5.00	T 12015	1.3202	T15	
T15 Plus	1.60	4.80	2.00	10.50	8.00	5.00	—	—	—	
M48	1.55	4.00	5.25	10.00	9.00	3.10	T 11348	—	M48	
HS-60	2.30	4.00	6.90	6.40	10.30	6.40	—	1.3241	—	
Maxamet®	2.15	4.75	—	13.00	10.00	6.00	—	—	—	
PD #1	1.10	7.75	1.60	1.10	—	2.35	—	—	—	Cold work steels, plastic injection molds, extrusion screws, bearings, gate valves, and industrial knives.
A11 LVC	1.85	5.30	1.30	—	—	9.00	—	—	—	
A11	2.45	5.30	1.30	—	—	9.80	T 30111	—	A11	
420 CW	2.25	12.80	1.30	—	—	9.25	—	—	—	
AerMet®	0.25	3.10	1.20	—	13.40	**Ni:** 11.10	K 92580	—	—	Cast and wrought steel for shafts and actuators.
Pyrotool® 7	0.05	19.00	3.00	**Ni & Co:** 52.50	**Columbium & Ta:** 5.25	**Ti:** 1.00 **Al:** 0.60	N 07718	—	—	Cast and wrought steel for high temperature tooling and dies.

Please contact us with your requests for alloys not listed. We have many more alloys available that space limitations prevent us from listing.

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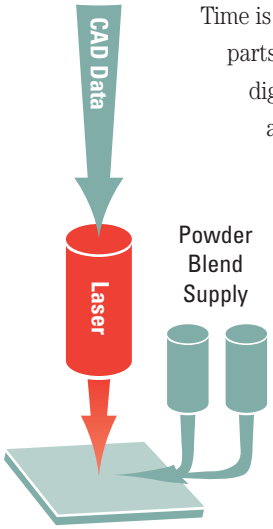
Net Shapes and Rapid Prototyping

Laser engineered net shapes, laser sintering, and similar additive manufacturing technologies offer significant cost savings and time reductions over traditional manufacturing processes. These technologies have been in use since the late 1980's and typically use CAD or similar programs to produce prototypes, molds, and low volume production parts with powder metals layer by layer until the net shape part is completed. Since the processes involve adding materials rather than removal by machining or grinding, less waste is generated, thereby saving material costs. Time is also saved as tooling is not required; parts can be produced directly from the digital design data, resulting in additional cost savings.

Laser Sintered Cone
Photo Courtesy of RPM & Associates



Laser and/or deposition surface moves on multiple axes as the parts are built layer by layer. Excess powder is removed and recycled.

CPP provides clean, spherical, gas atomized powders in a wide range of standard alloys for use with these manufacturing technologies. The powders are provided with very consistent chemistries and particle sizes to provide uniform products and production flow rates. Many of the more common alloys used are listed in this sheet. Should another alloy be required the Research & Development staff has extensive experience and facilities to provide what is required for your application.

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Producing metal powders for over 40 years, CPP has hundreds of years of combined experience and is committed to continuous manufacturing improvement. Strategic relationships are often initiated with customers to develop and supply new powder metal alloys in the exact specification which best suits the requirements of their application.

Standard Packaging

PE Bottles	5 kg	10 lbs
PE Pails	25 kg	50 lbs
Drums	250 kg	500 lbs

Standard Sizes

Micron	Mesh
125 / 45	-120/+325
105 / 45	-140/+325
53 / 22	-270/+22µ

Net Shape Manufacturing Powders

Micro-Melt®	Nominal Chemical Composition (typical values in wt.%)								UNS No.
	C	Cr	Ni	Mo	Si	Mn	Fe	Others	
23	≤1.30	4.00	—	5.00	0.35	0.30	Bal	**V:** 3.10	T11323
4140	0.4	1	—	0.2	0.2	0.9	Bal	—	G41400
4340	0.38-0.43	0.7-0.9	1.65-2.0	0.2-0.3	0.15-0.30	0.6-0.8	Bal	—	G43400
H13	0.4	5	—	1.3	1	0.3	Bal	**V:** 1	T20813
M4	1.45	4.50	—	4.50	0.40	0.40	Bal	**W:** 5.75, **V:** 4.00	T11304
T15	1.55	4.6	—	—	0.3	0.3	Bal	**W:** 12.5, **Co:** 5.0, **V:** 5.0	T12015
17-4	0.04-0.07	15-17	3-5	—	≤1.0	≤1.0	Bal	**Cu:** 3-5, **Nb:** 0.15-0.45	S17400
304L	≤0.03	18-19	9-11	—	0.2-0.75	1-2	Bal	—	S30403
316L	≤0.03	16-18	10-11	2-3	≤1.0	≤2.0	Bal	—	S31683
410	≤0.15	11.5-13.5	—	—	≤1.0	≤1.0	Bal	—	S41080
420	0.45	13.5	—	—	—	—	Bal	—	S42080
440C	0.95-1.2	16-18	≤1.0	0.4-0.75	≤1.0	≤1.0	Bal	—	S44004
420CW	2.25	12.8	—	1.3	0.9	≤0.5	Bal	**V:** 9.25	—
CCW	0.15	28.0	10.0	5.5	≤1.0	≤1.0	≤2.0	**W:** 4.5, **Ta:** 0.8, **Co:** Bal	—
CCM Plus®[1]	0.20-0.30	26.0-30.0	—	5.0-7.0	—	—	—	**Co:** Bal	—
600	≤0.10	15.5	Bal	—	—	—	7.5	—	—
622	≤0.02	21.5	Bal	13.5	0.5	0.4	3	**W:** 3.0	—
625	≤0.10	21.5	Bal	9.0	≤0.5	≤0.5	≤5.0	**Nb:** 3.6, **Ti:** ≤0.40, **Al:** ≤0.40	N06625
713	0.08-0.20	12.0-14.0	Bal	3.8-5.2	≤0.5	≤0.25	≤2.5	**Al:** 5.5-6.5, **Nb:** 1.8-2.8, **Ti:** 0.5-1.0, **Co:** ≤1.0	
718	0.02-0.08	17.0-21.0	Bal	2.8-3.3	≤0.35	≤0.35	≤19.0	**Al:** 0.3-0.7, **Nb:** 4.7-5.5, **Ti:** 0.6-1.1, **Co:** ≤0.3	N07718
M247	—	8.4	Bal	0.7	—	—	—	**Co:** 10, **W:** 10, **Al:** 5.5, **Ta:** 3, **Hf:** 1.4, **Ti:** 1	

1 U.S. Patent Number 5,462,575

The information and data presented herein are typical or average values and are not a guarantee of maximum or minimum values. Applications specifically for material described herein are made solely for the purpose of illustration to enable the reader to make his or her own evaluation and are not intended as warranties, either express or implied, of fitness for these or other purposes. There is no representation that the recipient of this literature will receive updated editions as they become available.

Please contact us with your requests for alloys not listed. We have many more alloys available that space limitations prevent us from listing.

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