

Material Product Data Sheet

Cobalt Chromium [Nickel Tungsten Silicon] Carbon Alloy Products (Similar to Stellite, Ultimet, Mar M 509)

Powder Products:

Amdry™ MM509, Amdry MM509-C, Metco™ 1220 series, Metco 1221A, Metco 1223A

Wire Products:

Metco 8100, Metco 8101, Metco 8102, Metco 8103

1 Introduction

Metco Joining & Cladding's CoCr[NiWSi]C powder products are inert gas atomized powders that are chemically homogeneous and free flowing. They provide excellent results in a variety of processes such as laser cladding and PTA. In addition, some of these products (Amdry MM509 series) can also be used as complimentary additive to ADB brazing alloys to facilitate crack and surface repairs.

The composite wire products have compositions similar to various types of Stellite and are designed for electric arc wire spray, GMAW (gas metal arc welding) or GTAW (gas tungsten arc welding).

These materials form coatings that are appropriate for combined wear and corrosion resistance in relatively high-temperature service conditions.

1.1 Typical Uses and Applications

Laser cladding and PTA:

- Excellent resistance to galling on self-mating surfaces such as valve seats
- Erosion resistance resulting from cavitation
- High-temperature corrosion and erosion resistance
- Abrasive wear resistance

Brazing:

- Filler metal to facilitate wide-gap activated diffusion brazing applications such as crack repair on gas turbine hot section blades and vanes

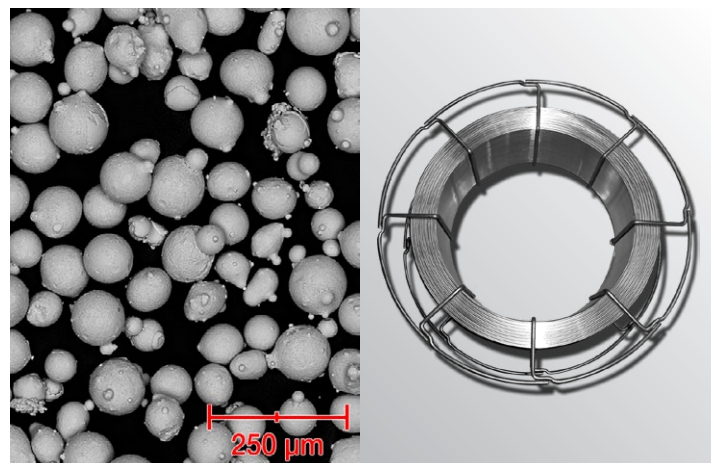
GMAW and GTAW:

Restoration or protection from abrasion or cavitation for:

- Dies, extrusion screws
- Chemical and petrochemical valves, seats and plugs
- Steam valves
- Bearing areas
- Chain saw bars, saw teeth
- Hot shears

Quick Facts

Classification	Alloy, cobalt-based
Chemistry	CoCrC[WC][MoNiC][MoWNi]
Manufacture	Gas atomized or cored wire
Morphology	Spheroidal (powder products only)
Melting Range	Various (see section 2.3)
Purpose	Wear and corrosion resistance at relatively high temperatures; repair and restoration
Process	Powders: Laser Cladding, PTA, Brazing Wires: GMAW, GTAW



Left: Gas-atomized Metco 1221A showing typical morphology of powder products. Right: Packaging for composite wire products.

2 Material Information

2.1 Chemical Composition

Product	Weight Percent (nominal)												
	Co	Cr	Mo	W	Ni	Fe	Mn	C	Si	Ta	Ti	Zr	Other
Metco 1220A	Bal.	28.5	---	4.5	---	≤ 3.0	---	1.08	1.6	---	---	---	< 0.5
Metco 1220B	Bal.	28.5	---	4.5	---	≤ 3.0	---	1.08	1.6	---	---	---	< 0.5
Metco 1220C	Bal.	28.5	---	4.5	---	≤ 3.0	---	1.08	1.6	---	---	---	< 0.5
Metco 1221A	Bal.	27.0	5.5	---	2.75	≤ 3.0	---	0.2	≤ 1.0	---	---	---	< 1.0
Metco 1223A	Bal.	25.5	5.0	2.0	9.0	3.5	---	0.08	0.06	---	---	---	< 0.1
Amdry MM509	Bal.	23.5	---	7.0	10.0	---	---	0.6	---	3.5	0.23	0.45	< 0.3
Amdry MM509-C	Bal.	23.5	---	7.0	10.0	---	---	0.6	---	3.5	0.23	0.45	< 0.3
Metco 8100	Bal.	27.5	---	11.0	---	1.0	1.4	2.4	0.6	---	---	---	N.R.
Metco 8101	Bal.	27.0	---	4.3	---	1.0	0.5	1.2	0.9	---	---	---	N.R.
Metco 8102	Bal.	26.0	---	7.0	2.0	1.0	0.3	1.4	1.0	---	---	---	N.R.
Metco 8103	Bal.	25.5	5.5	---	2.5	1.0	0.2	0.2	0.55	---	---	---	N.R.

N.R. = Not reported

2.2 Size

2.2.1 Particle Size Distribution (powder products)

Product	Nominal Range μm	Maximum Particle Size (μm) Provided in Wt. %									
		150 μm	125 μm	106 μm	75 μm	53 μm	45 μm	20 μm	11 μm	5 μm	
Metco 1220A	-150 +53	+ 3 %	---	---	---	- 3 %	---	---	---	---	
Metco 1220B	-106 +45	---	0	+ 3 %	---	- 3 %	---	---	---		
Metco 1220C	-53 +20	---	---	---	---	+ 5 %	---	- 5 %	---		
Metco 1221A	-125 +45	---	+ 3 %	---	---	---	- 2 %	---	---		
Metco 1223A	-125 +53	+ 1 %	+ 5 %	---	---	- 4 %	- 0.5 %	---	---		
Amdry MM509	-45 +5	---	---	---	---	---	+ 5 %	---	---		
Amdry MM509-C	-125 +45	---	+ 5 %	---	---	---	- 15 %	---	---		

Analysis for particle sizes 45 μm and above by sieve (ASTM B214); Analysis for particle sizes below 45 μm by laser diffraction (Microtrac)

2.2.2 Wire Diameters (composite wire products)

Product	Diameter		
	mm	in	ASTM gage
Metco 8100	1.2 or 1.6	0.047 or 0.063	17 or 14
Metco 8101	1.2 or 1.6	0.047 or 0.063	17 or 14
Metco 8102	1.2 or 1.6	0.047 or 0.063	17 or 14
Metco 8103	1.2 or 1.6	0.047 or 0.063	17 or 14

2.3 Other Properties

Product	Melting Range	Similar To	Previously Sold As
Metco 1220A	1260 – 1357 °C (2300 – 2475 °F)	Stellite 6	---
Metco 1220B	1260 – 1357 °C (2300 – 2475 °F)	Stellite 6	MetcoClad 6
Metco 1220C	1260 – 1357 °C (2300 – 2475 °F)	Stellite 6	MetcoClad 6F
Metco 1221A	1295 – 1435 °C (2363 – 2615 °F)	Stellite 21	MetcoClad 21
Metco 1223A	1332 – 1354 °C (2430 – 2470 °F)	Ultimet	MetcoClad 23
Amdry MM509	1383 – 1454 °C (2521 – 2649 °F)	Mar M 509	
Amdry MM509-C	1383 – 1454 °C (2521 – 2649 °F)	Mar M 509	
Metco 8100	1190 – 1345 °C (2175 – 2450 °F)	Stellite 1	
Metco 8101	1285 – 1410 °C (2340 – 2570 °F)	Stellite 6	
Metco 8102	1200 ° 1365 °C (2192 – 2489 °F)	Stellite 12	
Metco 8103	1295 – 1435 °C (2360 – 2615 °F)	Stellite 21	

2.4 Recommended Processes

Product	Laser Cladding	PTA	GMAW / GTAW	Braze ^a
Metco 1220A	✓	✓	✗	✗
Metco 1220B	✓	✓	✗	✓
Metco 1220C	✓	✗	✗	✗
Metco 1221A	✓	✓	✗	✗
Metco 1223A	✓	✓	✗	✗
Amdry MM509	✗	✗	✗	✓
Amdry MM509-C	✓	✓	✗	✓
Metco 8100	✗	✗	✓	✗
Metco 8101	✗	✗	✓	✗
Metco 8102	✗	✗	✓	✗
Metco 8103	✗	✗	✓	✗

PTA = Plasma Transferred Arc; **GMAW** = Gas Metal Arc Welding (MIG); **GTAW** = Gas Tungsten Arc Welding (TIG)

^a As a superalloy filler metal to be used with an appropriate braze alloy

2.5 Key Selection Criteria

Metco 1220 series

- Deposits have good resistance to seizing, galling and cavitation over a wide temperature range, and combat adhesive, abrasive or erosive wear combined with corrosion at relatively high temperatures. They provide good thermal oxidation resistance at temperatures up to 1000 °C (1800 °F). Deposits resist oxidizing acids, but perform poorly in strong reducing acids such as hydrochloric with the degree of resistance dependant on the acidic concentration and temperature. Self-mating surfaces exhibit a very low coefficient of friction (≈ 0.12).
- Choose Metco 1220A or Metco 1220B for laser cladding deposits of standard thickness.
- Choose Metco 1220C for deposits as thin as 0.5 mm (0.02 in). Its finer particle size distribution can save processing time and cost, as the time to grind to dimension is reduced.

Metco 1221A

- Choose Metco 1221A for applications where superior corrosion resistance is required, compared to the Metco 1220 series, especially in reducing environments. It also resists oxidizing acids like acetic, formic phosphoric and low-concentration sulfuric.
- Laser clad deposits of Metco 1221A have superior properties compared to conventionally welded overlays.
- In addition to high resistance to cavitation and galling, deposits of Metco 1221A resist high temperature metal-to-metal sliding wear with a low coefficient of friction and can be used on applications such as automotive piston rings.
- Laser clad surfaces exhibit superior impact resistance compared deposition using PTA (plasma transferred arc) welding.

Metco 1223A

- Metco 1223A is designed for good wear and corrosion resistance and produce excellent laser clad deposits. The alloy derives its mechanical properties from solid solution strengthening and minor carbide precipitation. It has excellent work hardening characteristics that offer better protection against high stress abrasion. When deposited using laser cladding, Metco 1223A exhibits almost no porosity and excellent wear resistance. Metco 1223A can be applied using plasma transferred arc (PTA). Relatively dense overlays can be obtained on compatible substrates.
- Choose Metco 1223A for applications where wear and erosion impact the surface at temperatures below 600 °C (1112 °F). It is recommended for applications, such as hydraulic piston rods, applied using laser cladding.

Amdry MM509 and Amdry MM509-C

- These products were designed as complimentary filler metals for repair and wide-gap brazing applications.
- Amdry MM509 and Amdry MM509-C are similar to Mar M 509 casting alloy that contains carbide-forming elements. As coatings, they are best applied using atmospheric plasma spray and is primarily used for surface restoration of worn or damaged gas turbine parts such as airfoils, combustors, blades and vanes.

Metco 8100

- Metco 8100 should be chosen when severe abrasion resistance or low-angle erosion resistance is required combined with good corrosion resistance. It maintains its hardness at temperatures up to 760 °C (1400 °F) in abrasion or erosion applications. It offers very good general resistance to seawater corrosion, but may not be the best choice to resist pitting or crevice corrosion. Choose Metco 8100 for pump applications to protect sleeves seal rings, impellers and bearing sleeves.
- Metco 8100 is not as tough or crack-resistant as some other alloys in this datasheet, therefore when welding with Metco 8100 be careful to minimize stresses resulting from substrate and deposit cooling.

Metco 8101

- Choose Metco 8101 for deposition by GMAW or GTAW for all-around wear and corrosion resistance or when good impact or cavitation resistance is needed. Metco 8101 is similar in composition to Stellite 6. Deposits are resistant to many forms of wear, including galling. It is also resistant to chemical attack over a wide temperature range. It is resistant to oxidizing acids but are not recommended for reducing acids. It offers good resistance in saline environments.
- It can be used when a hard surface is needed up to 500 °C (930 °F).

Metco 8102

- Choose Metco 8102 is designed for deposition by GMAW or GTAW and has a composition similar to Stellite 12. It is often chosen when a material that has properties between Metco 8100 and Metco 8101 are needed in that provides higher resistance to abrasion, low-angle erosion and sliding wear resistance compared to Metco 8101, while still providing good resistance to impact and cavitation. It is also recommended to run against a mating surface of Metco 8101.
- It can be used when a hard surface is needed up to 700 °C (1290 °F).

Metco 8103

- Deposits of Metco 8103 exhibit excellent resistance to thermal and mechanical shock. It is also an excellent choice to resist cavitation, galling and sliding wear. It is not as good a choice for abrasive wear as may be other products in this datasheet. Choose Metco 8103 for resistance to both oxidizing and reducing atmospheres. Its capability to survive in reducing environments involving sulfuric acid, hydrochloric acid and sour gas makes Metco 8103 a popular choice for petrochemical and power generation applications.
- Exercise care when machining deposits of Metco 8103 as they can have a tendency to work harden.

2.6 Related Products

- The CoMoCrSi alloys (Triballoy family) are particularly suitable where lubrication is low or nonexistent. They are known for their excellent high temperature sliding wear, corrosion, oxidation and general wear properties. Characterized by molybdenum-rich phases dispersed in a softer cobalt matrix, coatings perform well in reducing environments such as hydrochloric, formic and sulfuric acids; oxidizing environments, such as ferric chloride; non-oxidizing environments, such as phosphoric and acetic acid and saltwater. Excellent sliding wear resistance is combined with good hot corrosion resistance and moderate oxidation resistance at temperatures up to approximately 800 °C (1470 °F). These products include:

Product	Similar To
Diamalloy 3001NS	Triballoy 800
Metco 68F-NS	Triballoy 800
Diamalloy 3002NS	Triballoy 400
Metco 66F-NS	Triballoy 400

- Metco Joining & Cladding offers a complete portfolio materials for wear resistance, corrosion resistance, general surface build-up and restoration, including nickel-based superalloy materials. Please contact your Metco Joining & Cladding Account Representative for further information.

2.7 Customer Specifications

Product Name	Customer Specifications
Amdry MM509	Canada Pratt Whitney CPW 549-2 Chromalloy B-88 GE B50A988, CI B GE Part # 372A4430P001 Pratt & Whitney Component Repairs MS 1068 Pratt & Whitney PWA 1185-2 Tulsa Airfoil Repair MS 1068
Amdry MM509-C	GE B50A988, Class A

3 Application Information

3.1 Parameters

Please contact your Metco Joining & Cladding Account Representative for parameter availability. For specific coating application requirements, the services of Metco Joining & Cladding Coating Solution Centers are available.

4 Commercial Information

4.1 Ordering Information and Availability

Product	Order No.	Wire Diameter	Package Size	Availability	Distribution
Metco 1220A	1301056	---	5 kg (approx. 11 lb)	Stock	Global
Metco 1220B	1301057	---	5 kg (approx. 11 lb)	Stock	Global
Metco 1220C	1301058	---	5 kg (approx. 11 lb)	Stock	Global
Metco 1221A	2280106	---	5 kg (approx. 11 lb)	Special Order	Global
Metco 1223A	2280105	---	5 kg (approx. 11 lb)	Stock	Global
Amdry MM509	1002099	---	5 kg (approx. 11 lb)	Stock	Global
Amdry MM509-C	1059330	---	10 lb (approx. 4.5 kg)	Stock	Global
Metco 8100	1057901	1.6 mm (0.063 in)	12.5 kg (27.5 lb) Wire Basket	Special Order	Global
	1501542	1.2 mm (0.047 in)	12.5 kg (27.5 lb) Wire Basket	Special Order	Global
Metco 8101	1501555	1.6 mm (0.063 in)	12.5 kg (27.5 lb) Wire Basket	Special Order	Global
	1501547	1.2 mm (0.047 in)	12.5 kg (27.5 lb) Wire Basket	Special Order	Global
Metco 8102	1501566	1.6 mm (0.063 in)	12.5 kg (27.5 lb) Wire Basket	Special Order	Global
	1501560	1.2 mm (0.047 in)	12.5 kg (27.5 lb) Wire Basket	Special Order	Global
Metco 8103	1501587	1.6 mm (0.063 in)	12.5 kg (27.5 lb) Wire Basket	Special Order	Global
	1501572	1.2 mm (0.047 in)	12.5 kg (27.5 lb) Wire Basket	Special Order	Global

4.2 Handling Recommendations

- Store in the original container in a dry location.
- For powder products, tumble contents prior to use to prevent segregation.
- Open containers should be stored in a drying oven to prevent moisture pickup.

4.3 Safety Recommendations

See the SDS (Safety Data Sheet) in the version localized for the country where the material will be used. SDS are available from the Metco Joining & Cladding web site at www.metco-joiningcladding.com (Resources – Safety Data Sheets).

Product	SDS No.
Metco 1220A	50-2247
Metco 1220B	50-2247
Metco 1220C	50-2247
Metco 1221A	50-1653
Metco 1223A	50-1828
Amdry MM509	50-1023
Amdry MM509-C	50-1023
Metco 8100	50-2529
Metco 8101	50-2530
Metco 8102	50-2533
Metco 8103	50-2534

Stellite is a registered trademark of Kennametal Inc.
Ultimet is a registered trademark of Haynes International, Inc.

Information is subject to change without prior notice.