oerlikon
metco

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, Diamalloy™ 4060NS, Metco™ 1220 series, Metco 45C-NS, Metco 45VF-NS, Metco 1221A, Metco 1223A
Wire Products:
Metco 8100, Metco 8101, Metco 8102, Metco 8103

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:	HVOF, atmospheric plasma spray, combustion powder spray
	Wires:	Electric arc wire spray

1 Introduction

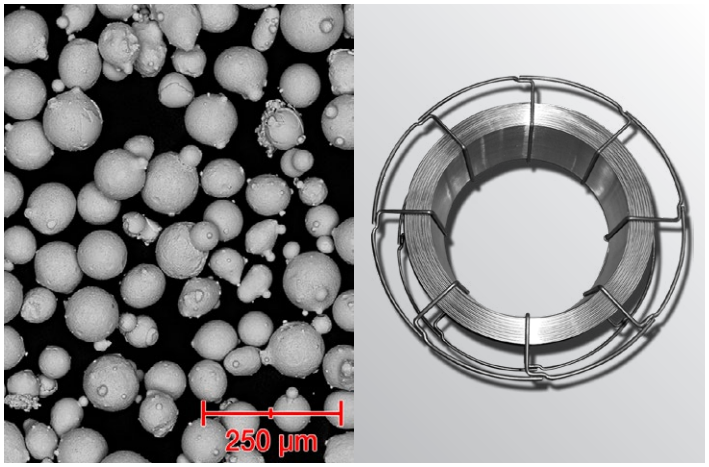
Oerlikon Metco's CoCr[NiWSi]C powder products are inert gas atomized powders that are chemically homogeneous and freely flowing. They provide excellent results for a variety of powder-fed thermal spray processes.

The composite wire products have compositions similar to various types of Stellite and are designed for electric arc wire spray.

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

- Resistance to abrasive grains, hard surfaces, fretting and particle erosion at high temperatures for components such as piston rings, exhaust valves and seats, forging tools, hot crushing rolls, pump components, turbine vanes and air seals
- Surface restoration of worn or damaged gas turbine components such as airfoils, combustors, blades and vanes
- Gas turbine hot section applications such as combustion liner components
- Salvage and build-up applications on cobalt-based alloys



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 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
Diamalloy 4060NS	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 45C-NS	Bal.	25.5	---	7.5	10.5	---	---	0.50	---	---	---	---	N.R.
Metco 45VF-NS	Bal.	25.5	---	7.5	10.5	---	---	0.50	---	---	---	---	N.R.
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 1220B	-106 +45	---	0	+ 3 %	---	---	– 3 %	---	---	---
Metco 1220C	-53 +20	---	---	---	---	+ 5 %	---	– 5 %	---	---
Diamalloy 4060 NS	-45 +11	---	---	---	---	---	+ 5 %	---	– 2 %	---
Metco 1221A	-125 +45	---	+ 3 %	---	---	---	– 2 %	---	---	---
Metco 45C-NS	-75 +45	---	---	---	+ 5 %	---	– 10 %	---	---	---
Metco 45VF-NS	-45 +5	---	---	---	---	---	+ 1 %	---	---	– 2 %
Metco 1223A	-125 +53	+ 1 %	+ 5 %			– 4 %	– 0.5 %	---	---	---
Amdry MM509	-45 +5	---	---	---	---	---	+ 5 %	---	---	– 10 %
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 1220B	1260 – 1357 °C (2300 – 2475 °F)	Stellite 6	MetcoClad 6
Metco 1220C	1260 – 1357 °C (2300 – 2475 °F)	Stellite 6	MetcoClad 6F
Diamalloy 4060 NS	1260 – 1357 °C (2300 – 2475 °F)	Stellite 6	
Metco 1221A	1295 – 1435 °C (2363 – 2615 °F)	Stellite 21	MetcoClad 21
Metco 45C-NS	1340 – 1395 °C (2445 – 2545 °F)	Stellite 31	
Metco 45VF-NS	1340 – 1395 °C (2445 – 2545 °F)	Stellite 31	
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 ³F)	Stellite 21	

2.4 Recommended Processes

Product	HVOF	APS	CPS	EAW [a]
Metco 1220B	✗	✓	✗	✗
Metco 1220C	✗	✓	✗	✗
Diamalloy 4060 NS	✓	✓	✓	✗
Metco 1221A	✗	✓	✗	✗
Metco 45C-NS	✗	✓	✓	✗
Metco 45VF-NS	✗	✓	✗	✗
Metco 1223A	✗	✓	✗	✗
Amdry MM509	✗	✓	✗	✗
Amdry MM509-C	✗	✓	✗	✗
Metco 8100	✗	✗	✗	✓
Metco 8101	✗	✗	✗	✓
Metco 8102	✗	✗	✗	✓
Metco 8103	✗	✗	✗	✓

HVOF = High Velocity Oxygen Fuel Spray; **APS** = Atmospheric Plasma Spray; **CPS** = Combustion Powder Thermospray™; **EAW** = Electric Arc Wire Spray;
[a] 1.6 mm wire diameter

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 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.

Diamalloy 4060NS

- Diamalloy 4060NS is used as a general restoration and repair material when compatibility with Stellite 6 is desired. When applied using HVOF, it forms dense, wear-resistant and oxidation-resistant coatings that may be used for turbine hot section applications such as combustion liners.

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.
- In addition to high resistance to cavitation and galling, Metco 1221A resists high temperature metal-to-metal sliding wear with a low coefficient of friction and can be used on applications such as automotive piston rings.

Metco 45C-NS and Metco 45VF-NS

- Metco 45C-NS and Metco 45VF-NS are similar to Stellite 31 (Stellite X40) and are generally applied using atmospheric plasma spray. They have the same elemental composition, but are differentiated by particle size. Coatings are resistant to wear by abrasive grains, hard surfaces, fretting and particle erosion at high temperatures. They are recommended for salvage and build-up applications. The coatings are useful in gas turbine engines at high temperatures up to 850 °C (1550 °F), and for metal working components which require a combination of mechanical integrity and hot wear resistance.
- Metco 45C-NS can be applied using atmospheric plasma spray or combustion powder spray. It differs from Metco 45VF-NS in that it produces thicker coatings that are softer. The thickness limitation of Metco 45C-NS coatings is 1.8 mm (0.070 in). Thicker coatings may require specialized spray techniques.
- Metco 45VF-NS is intended to be used for thin coatings, up to a maximum thickness of 0.4 mm (0.015 in). The coatings produced are smoother and harder than coatings produced using Metco 45C-NS and Amdry X40.

Metco 1223A

- Metco 1223A is designed for good wear and corrosion resistance. 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.
- Choose Metco 1223A for applications where wear and erosion impact the surface at temperatures below 600 °C (1112 °F)

Amdry MM509 and Amdry MM509-C

- These products were designed as complimentary filler metals for repair.
- 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 spraying Metco 8100 be careful to minimize stresses resulting from substrate and deposit cooling.

Metco 8101

- Choose Metco 8101 for deposition by electric arc wire spray 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

- Metco 8102 is designed for deposition by electric arc wire spray 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 know 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). Oerlikon Metco products include:

Product	Similar To	Recommended Spray Process	
		HVOF	APS [a]
Diamalloy 3001NS	Tribaloy 800	✓	✗
Metco 68F-NS	Tribaloy 800	✗	✓
Diamalloy 3002NS	Tribaloy 400	✓	✗
Metco 66F-NS	Tribaloy 400	✗	✓

[a] APS: Atmospheric Plasma Spray

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

2.7 Customer Specifications

Product Name	Customer Specifications	
Amdry MM509	Chromalloy B-88 GE B50A988, Cl B GE Part # 372A4430P001	Pratt & Whitney Component Repairs MS 1068 Pratt & Whitney PWA 1185-2
Metco 45C-NS	Canada Pratt & Whitney CPW 218 Chromalloy CP 6029 GKN Aerospace PM 819-18 MTU MTS 1228 Pratt & Whitney PWA 1318	Rolls-Royce OMA 3/81B Rolls-Royce plc MSRR 9507/3 Rolls-Royce plc RRMS 40037 SAE International AMS 5791 Snecma DMR 33.007
Metco 45VF-NS	Canada Pratt & Whitney CPW 236 CFM International CP 6002 GKN Aerospace PM 819-16 Honeywell M3963 MTU MTS 1346	Pratt & Whitney PWA 1316 Rolls-Royce plc MSRR 9507/23 Rolls-Royce plc RRMS 40043 Snecma DMR 33.008 U. S. Military MIL-P-83348, Comp C, Type 1, Cl 1
Diamalloy 4060NS	GE B50A960 *	
Amdry MM509	Canada Pratt Whitney CPW 549-2 GE B50A988, Class B	Pratt Whitney PWA 1185-2 Tulsa Airfoil Repair MS 1068
Amdry MM509-C	GE B50A988, Class A	

* Meets the requirements of this specification, but not approved.

3 Application Information

3.1 Parameters

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

Recommended Spray Guns			
Atmospheric Plasma	**HVOF**	**Combustion Powder**	**Electric Arc Wire**
Metco 3MBM	DiamondJet series	Metco 5P-II	Smart Arc
SinplexPro	WokaJet series	Metco 6P-II series	LD Schub 5
Metco F4MB-XL series	WokaStar series		

4 Commercial Information

4.1 Ordering Information and Availability

Product	Order No.	Wire Diameter	Package Size	Availability	Distribution
Metco 1220B	1301057	---	5 kg (approx. 11 lb)	Stock	Global
Metco 1220C	1301058	---	5 kg (approx. 11 lb)	Stock	Global
Diamalloy 4060NS	1037003	---	10 lb (approx. 4.5 kg)	Stock	Global
Metco 1221A	2280106	---	5 kg (approx. 11 lb)	Special Order	Global
Metco 45C-NS	1000081	---	5 lb (approx. 2.2 kg)	Stock	Global
Metco 45VF-NS	1000083	---	5 lb (approx. 2.2 kg)	Stock	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 1501542	1.6 mm (0.063 in) 1.2 mm (0.047 in)	12.5 kg (27.5 lb) Wire Basket 12.5 kg (27.5 lb) Wire Basket	Special Order Special Order	Global Global
Metco 8101	1501555 1501547	1.6 mm (0.063 in) 1.2 mm (0.047 in)	12.5 kg (27.5 lb) Wire Basket 12.5 kg (27.5 lb) Wire Basket	Special Order Special Order	Global Global
Metco 8102	1501566 1501560	1.6 mm (0.063 in) 1.2 mm (0.047 in)	12.5 kg (27.5 lb) Wire Basket 12.5 kg (27.5 lb) Wire Basket	Special Order Special Order	Global Global
Metco 8103	1501587 1501572	1.6 mm (0.063 in) 1.2 mm (0.047 in)	12.5 kg (27.5 lb) Wire Basket 12.5 kg (27.5 lb) Wire Basket	Special Order Special Order	Global 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 Oerlikon web site at www.oerlikon.com/metco (Resources – Safety Data Sheets).

Product	SDS No.
Metco 1220B	50-2247
Metco 1220C	50-2247
Diamalloy 4060NS	50-505
Metco 1221A	50-1653
Metco 45C-NS	50-114
Metco 45VF-NS	50-114
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

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