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metco

Material Product Data Sheet
Cobalt Chromium (Nickel) Tungsten Carbon Alloy Powders

Thermal Spray Powder Products:
Amdry™ MM509, Amdry X40, Metco™ 45C-NS, Metco 45VF-NS, Diamalloy 4060NS

1 Introduction

Oerlikon Metco's family of CoCr[Ni]WC alloy powders produce dense, well-bonded coatings that resist oxidation and high temperature wear.

The addition of tungsten and carbon produces tungsten carbide within the coating to increase hardness and improve wear properties.

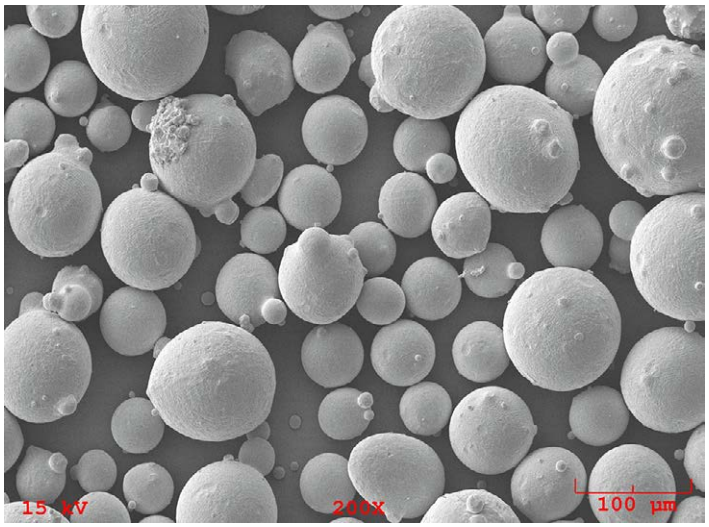
In addition to providing various wear-resistant functions, the coatings are also recommended for salvage and build-up applications.

These materials are manufactured by inert gas atomization, ensuring homogeneous chemistry and freely flowing spheroidal powder particles that feed well.

1.1 Typical Uses and Applications

- High temperature coatings to resist abrasive grains, hard surfaces, fretting and particle erosion for fuel rod mandrels, forging tools, pump components, hot crushing rolls, turbine air seals, turbine vanes, exhaust valves and seats.
- Surface restoration of worn or damaged gas turbine components such as airfoils, combustors, blades and vanes.
- Gas turbine hot section applications such as combustion liners.
- Salvage and build-up applications on cobalt and cobalt-based alloy substrates.

Quick Facts	
Classification	Alloy, cobalt-based
Chemistry	CoCr[Ni]WC (similar to Stellite)
Manufacture	Gas atomized
Morphology	Spheroidal
Service temperature	≤ 840 °C (1550 °F)
Purpose	Wear and oxidation resistance on cobalt-based substrates
Process	HVOF, Atmospheric Plasma Spray or Combustion Powder Thermospray™



2 Material Information

2.1 Chemical Composition

Product	Nominal Chemical Composition (wt. %)								
	Co	Cr	Ni	W	C	Si	Ta	Ti	Zr
Amdry MM509	Balance	23.4	10.0	7.0	0.60	---	3.5	0.23	0.45
Amdry X40	Balance	25.5	10.5	7.5	0.50	---	---	---	---
Metco 45C-NS	Balance	25.5	10.5	7.5	0.50	---	---	---	---
Metco 45VF-NS	Balance	25.5	10.5	7.5	0.50	---	---	---	---
Diamalloy 4060NS	Balance	28.5	---	4.5	1.08	1.6	---	---	---

2.2 Particle Size Distribution, Manufacturing Method and Comparison to Similar Alloys

Product	Nominal Range (µm)	Manufacturing Method	Chemistry Similar To:
Amdry MM509	–45 +5	Gas Atomized	Mar M 509
Amdry X40	–106 +37	Gas Atomized	Stellite 31
Metco 45C-NS	–75 +45	Gas Atomized	Stellite 31
Metco 45VF-NS	–45 +5	Gas Atomized	Stellite 31
Diamalloy 4060NS	–45 +11	Gas Atomized	Stellite 6

Microtrac by laser light diffraction per ASTM C 1070; screen analysis per ASTM Standard B214

2.3 Recommended Thermal Spray Processes

Product	HVOF	Atmospheric Plasma Spray	Combustion Powder Thermospray™
Amdry MM509	✗	✓	✗
Amdry X40	✗	✓	✗
Metco 45C-NS	✗	✓	✓
Metco 45VF-NS	✗	✓	✗
Diamalloy 4060NS	✓	✓	✓

2.4 Key Selection Criteria

- Always choose the product that meets the required customer material and process specifications.
- Amdry MM509 is similar to Mar M 509 casting alloy that contains carbide-forming elements. Amdry MM509 is 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.
- Amdry X40, Metco 45C-NS and Metco 45VF-NS are similar to Stellite 31 (Stellite X40) and are applied using atmospheric plasma spray. They have the same elemental composition, but are differentiated by their particle size and morphology. Coatings of these materials are resistant to wear by abrasive grains, hard surfaces, fretting and particle erosion at high temperatures. They are also 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 1.78 mm (0.070 in). Thicker coatings may require specialized spray techniques.
- Metco 45F-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.
- Diamalloy 4060NS is used as a general restoration and repair material when compatibility with Stellite 6 is desirable. It forms dense, wear-resistant and oxidation-resistant coatings that may be used for turbine hot section applications such as combustion liners. Diamalloy 4060NS is applied using HVOF.

2.5 Related Products

- When coating application by electric arc wire spray is desired, Metco 8100 [Co 32Cr 13W 2.5C 2.5Fe 2.5Ni) is a cored wire that can be used to produce coatings where wear, corrosion and oxidation resistance is required at temperatures up to 900 °C (1650 °F).
- 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

2.6 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
Amdry X40	Chromalloy BZ-003 Type 25 GE B50TF185, Cl A
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, Composition C, Type 1, Class 1
Diamalloy 4060NS	GE B50A960 *

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

3 Coating Information

3.1 Key Thermal Spray Coating Information

All data is approximate and will vary depending on spray process, coating equipment and parameters used.

Specification		Metco 45C-NS			Metco 45VF-NS	Diamalloy 4060NS
Spray process [a]		CP	APS	APS	APS	HVOF
Spray gun		5P-II or 6P-II	3MB	3MB	3MB	DJ2600
Process gases		oxygen/ acetylene	argon/ hydrogen	nitrogen/ hydrogen	argon/ hydrogen	oxygen/ hydrogen
Deposit efficiency %		90	40 – 50	75	65	55
Macrohardness		61 HRA	59 HRA	68 HRA	78 HR15N	86 – 89 HR15N
Typical porosity	vol. %	< 2	< 2	< 2	< 1	< 1
Density	g/cm^3	7.3	7.7	7.3	7.6	–
Surface roughness (Ra)						
	As sprayed µm	9 – 11	9 – 11	9 – 11	6 – 8	4 – 5
	µin	350 – 450	350 – 450	350 – 450	250 – 350	150 – 200
Recommended finishing		Machine using carbide tools or grind			Green silicon carbide-diamond wheel with water-based rust inhibitor coolant. Diamond lap for high luster	

[a] APS = Atmospheric Plasma Spray, CP = Combustion Powder Thermospray™, HVOF = High Velocity Oxy-Fuel Spray

3.2 Coating 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**
Metco 3MB series	DiamondJet series	Metco 5P-II
SinplexPro	WokaJet series	Metco 6P-II series
Metco F4 series	WokaStar series	

4 Commercial Information

4.1 Ordering Information and Availability

Product	Order No.	Package Size	Availability	Distribution
Amdry MM509	1002099	5 lb (approx. 2.25 kg)	Stock	Global
Amdry X40	1002391	5 lb (approx. 2.25 kg)	Special Order	Global
Metco 45C-NS	1000081	5 lb (approx. 2.25 kg)	Stock	Global
Metco 45VF-NS	1000083	5 lb (approx. 2.25 kg)	Stock	Global
Diamalloy 4060NS	1037003	10 lb (approx. 4.5 kg)	Stock	Global

4.2 Handling Recommendations

Store in the original container in a dry location. Carefully tumble contents prior to use to prevent segregation, but avoid breakdown of friable components.

Open containers should be stored in a drying oven at temperatures to prevent moisture pickup. Remove desiccant bag prior to use, if applicable.

4.3 Safety Recommendations

See the SDS (Safety Data Sheet) in the localized version applicable to the country where the material will be used. SDS are available from the Oerlikon Metco web site at www.oerlikon.com/metco (Resources – Safety Data Sheets).

Product	SDS
Amdry MM509	50-1023
Amdry X40	50-114
Metco 45C-NS	50-114
Metco 45VF-NS	50-114
Diamalloy 4060NS	50-505

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