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metco

Material Product Data Sheet
Tungsten Carbide – 17 % Cobalt Agglomerated and Sintered Powders

Powder Products:
Amdry™ 9831, Diamalloy™ 2005NS, Metco™ 5143, Metco 73F-NS-1, Metco 73F-NS-1 (-45), Metco 73F-NS-2, Metco 73SF-NS, Woka 3202, Woka 3203, Woka 3208

1 Introduction

These products are spheroidal, agglomerated and sintered powders for thermal spraying containing 83 % tungsten carbide as hard material and a cobalt matrix, which functions as a binder material for the carbide particles.

Coatings of these materials provide a higher toughness and fretting resistance than coatings of 88WC 12Co as a result of the higher cobalt levels.

Coatings made from tungsten carbide-containing materials protect substrates from the effects of fretting, abrasive grains, particle erosion, sliding wear, hammer wear (impact resistance), cavitation and dynamic contact with hard surfaces. They can be used as an alternative for hard chromium plating when these wear mechanisms are evident and for the recommended service environments and temperatures.

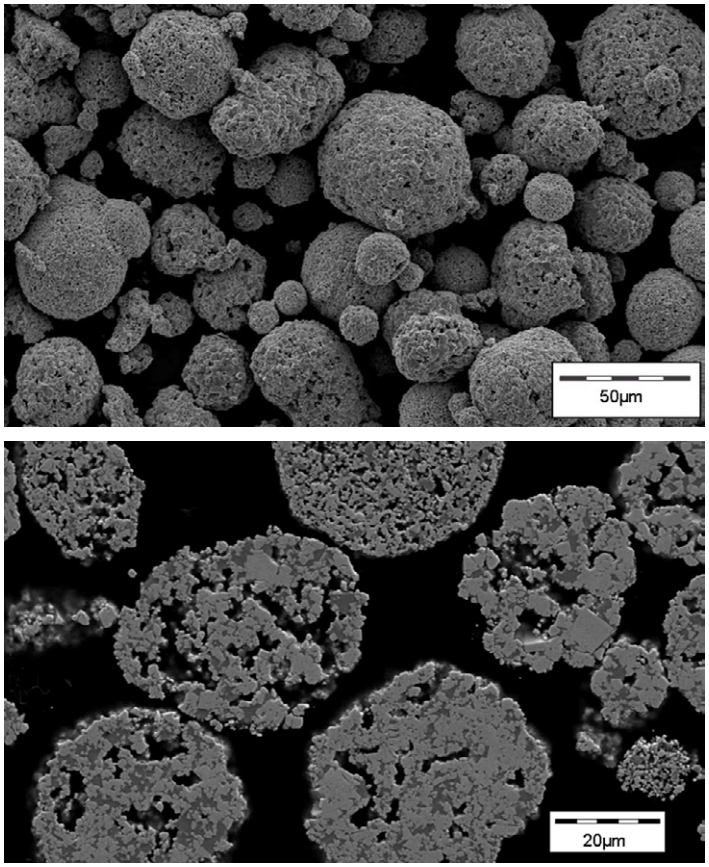
Coatings of these materials are dense and show good bond strength when applied using the HVOF process or the APS process using a TriplexPro™ series gun.

1.1 Typical Uses and Applications

Tungsten carbide – 17 % cobalt materials from Oerlikon Metco are among the best-known thermal spray powders for use in wear applications in non-corrosive media at service temperatures below 500 °C (930 °F) . Typical applications include:

- Landing gears
- Mid-span stiffeners (shrouds)
- Pump seals
- Sucker rod couplings
- Extrusion dies
- Aircraft flap tracks
- Exhaust fans
- Crushing rollers

Quick Facts	
Classification	Carbide, tungsten-based
Chemistry	83WC 17Co
Manufacture	Agglomerated and sintered
Morphology	Spheroidal
Purpose	Ductile wear resistance
Apparent Density	2.7 – 5.9 g/cm^3
Flowability	Free-flowing powder
Service Temperature	≤ 500 °C (930 °F)
Process	HVOF or atmospheric plasma spray



SEM photomicrographs showing powder morphology (top) and internal structure (bottom).

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2 Material Information

2.1 Chemical Composition

	Weight Percent (nominal)			
	Tungsten	**Cobalt**	**Carbon (total)**	**Iron (max)**
Amdry 9831	Balance	15.0 – 18.0	4.8 – 5.6	2.0
Diamalloy 2005NS	Balance	15.5 – 18.0	4.85 – 5.6	1.5
Metco 5143	Balance	16.0 – 18.0	4.85 – 5.4	0.4
Metco 73F-NS-1	Balance	15.5 – 18.0	4.95 – 5.5	1.0
Metco 73-NS-1(-45)	Balance	15.5 – 18.0	4.95 – 5.5	1.0
Metco 73F-NS-2	Balance	16.0 – 18.0	4.95 – 5.5	1.0
Metco 73SF-NS	Balance	16.0 – 18.0	4.95 – 5.5	1.0
Woka 3202	Balance	14.5 – 19.5	4.7 – 5.5	0.2
Woka 3203	Balance	14.5 – 19.5	4.7 – 5.5	0.2
Woka 3208	Balance	14.5 – 19.5	4.7 – 5.5	0.2

2.2 Particle Size Distribution and Apparent Density

	Nominal Range (µm)	**Primary Carbide Grain Size**	**Apparent Density (g/cm^3)**
Amdry 9831	-53 +11	Coarse	4.3 – 5.9
Diamalloy 2005NS	-45 +5.5	Coarse	2.9 min
Metco 5143	-45 +15	Medium	3.7 – 4.1
Metco 73F-NS-1	-53 +11	Coarse	< 2.9
Metco 73F-NS-1 (-45)	-45 +11	Coarse	3.2 – 4.2
Metco 73F-NS-2	-53 +11	Coarse	2.7 – 4.0
Metco 73SF-NS	-38 +5.5	Medium	3.4 – 4.0
Woka 3202	-45 +15	Medium	4.5 – 5.1
Woka 3203	-45 +11	Medium	4.4 – 5.0
Woka 3208	-90 +45	Medium	4.8 – 5.4

- Particle size distribution: Analysis by sieve per ASTM B214 for all upper limits and lower limits for particle sizes ≥ 20 µm. Lower limit analysis for particle sizes < 20 µm based on laser scattering per ASTM C 1070 (Microtrac). All particle sizes can be 10 wt. % max above specified upper or below specified lower values.
- Other particle size distributions are available on request for Woka-brand products.

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2.3 Key Selection Criteria

- Select a material appropriate for the recommended spray process and spray gun to be used. (refer to Section 2.5).
- For the lowest possible 'as-sprayed' surface roughness, choose a material with the lowest possible particle size distribution and carbide particle grain size.
- Choose the material that meets the required customer or OEM material and/or process specification (refer to Section 2.6).
- Metco 5143 is a cost-effective alternative with improved deposit efficiency compared to Diamalloy 2005NS, Amdry 9831 and Metco 73F series. IPlease see Section 2.6 for the specifications these materials can be certified to or fulfills requirements. Metco 5143 can be applied using the atmospheric plasma or HVOF spray processes.
- Amdry 9831 is recommended for application via the atmospheric plasma spray process. Typical applications are rod liners and lathe centers. As-sprayed coatings are very smooth, so that post-coating finishing may not be required for many applications.
- Diamalloy 2005NS is designed to be applied using HVOF spray processes and meets several customer specifications (refer to Section 2.6). It is recommended if thick coatings are necessary.
- Metco 73F-NS-1, Metco 73F-NS-1 (-45) and Metco 73F-NS-2 are recommended for application using the atmospheric plasma spray process. Coating thickness should be limited to a maximum of 0.4 mm (0.016 in) as thicker coatings are at risk of cracking.
- Metco 73SF-NS contains finer carbide particles and has a finer overall particle size distribution than Metco 73FNS-1, Metco 73F-NS-1 (-45) and Metco 73F-NS-2 (see Section 2.2) and is recommended for application using the atmospheric plasma spray process. It produces very smooth as-sprayed surfaces. Fretting wear resistance is equal to or better than coatings of Metco 73F-NS-1.
- For aerospace coatings applied using the DiamondJet™ gun, materials with low apparent densities are preferred as these products produce coatings with compressive stresses measured as Almen deflection values. In particular, this is a requirement for landing gear applications. These materials include Diamalloy 2005NS and Metco 5143.
- Woka 32xx series materials are not designed for use in aerospace and/or turbine applications and cannot be certified to these specifications. These materials are excellent choices for coatings on machine parts, pump seals, extrusion dies and crushing rollers.

2.4 Related Products

- For better corrosion resistance choose:
  - A tungsten carbide product that contains chromium within the binder matrix such as Woka 365x series products, Metco 516x series products, Diamalloy 5847-1, Metco 5847 or Woka 360x series products.
  - Chromium carbide materials such as Woka 71xx, Woka 72xx or Woka 73xx series products.
- For applications where service temperatures are greater than 500 °C (930 °F), but less than 700 °C (1290 °F), choose a material that contains both chromium carbide and tungsten carbide, such as Woka 75xx or Woka 37xx series products.
- When service temperatures exceed 700 °C (1290 °F), choose a chromium carbide material with a nickel-chromium matrix such as Woka 71xx, Woka 72xx or Woka 73xx series products.
- If higher hardness or better abrasion resistance is required, choose:
  - A tungsten carbide material with a cobalt-chromium matrix such as Woka 365x series products, Metco 516x series products, Metco 5847.
  - A tungsten carbide cobalt material with a lower matrix content such as Woka 31xx series materials.

2.5 Recommended Spray Process and Spray Guns

	HVOF					APS
	Diamond Jet	WokaJet / WokaStar / JP5000	K2	Jet Kote	Top Gun / HV2000	TriplexPro / 9MB / F4, etc.
Amdry 9831						●
Diamalloy 2005NS	●					
Metco 5143	●	●	●	●	●	●
Metco 73F-NS-1						●
Metco 73F-NS-1 (-45)						●
Metco 73F-NS-2						●
Metco 73SF-NS						●
Woka 3202	●	●			●	
Woka 3203	●					
Woka 3208						●

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2.6 Customer Specifications

Product	Approved Specifications [a]	Fulfills Requirements [b]
Amdry 9831	Rolls-Royce OMAT 3/114D Rolls-Royce plc MSRR 9507/1	
Diamalloy 2005NS	Boeing BMS 10-67, Type I Chemtronics OPS Man. 5.4.3 de Havilland DHMS C4.19 (except 3.3.1) GE B50TF167, Cl A GKN Aerospace PM 819-63 Goodrich LGMS 9011 Type I Pratt & Whitney PWA 36331-2 Rolls-Royce Corporation EMS 39660 Rolls-Royce OMAT 3/276 Rolls-Royce plc MSRR 9507/69 Rolls-Royce plc RRMS 40015 Sumitomo SMM-904	
Metco 5143	Bombardier DHMS C4.19 de Havilland DHMS C4.19 Rolls-Royce MSRR 9507/69 Rolls-Royce RRMS 40015 SAE International AMS 7881, Method 1 and 2	Boeing BMS 10-67 Type 1 CFM International CP 6004 Chemtronics OP Man. 5.4.3 GE B50TF167 Class A and C GKN Aerospace PM 819-52 GKN Aerospace PM 819-63 Honeywell EMS 39660 Pratt and Whitney PWA36331-2 Rolls-Royce Corp. EMS 39660 SNECMA DMR 33-019 SNECMA DMR 33-501 Turbomeca LA 657
Metco 73F-NS-1	Avio 4800M/15 CFM International CP 6004 CFM International CP 6035 Chromalloy BZ-003 Type 42 GE B50TF167, Cl A GKN Aerospace PM 819-52 Honeywell M3975 Snecma DMR 33.019 Snecma DMR 33.501	
Metco 73F-NS-1 (-45)	GE B50TF167, Cl. A	
Metco 73F-NS-2	Lucas Aerospace LA-M-093 Rolls-Royce OMAT 3/114C Rolls-Royce plc RRMS 40032	
Metco 73SF-NS	GKN Aerospace PM 819-80 Industria de Turbo Propulsores SMM-926 Rolls-Royce plc MSRR 9507/42	

a Oerlikon Metco can provide certification that the product meets these approved specifications
b Material fulfills these specifications but is not approved for certification

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3 Coating Information

3.1 Key Thermal Spray Coating Information

Specification		Typical Data [a]	
Recommended Spray Process		HVOF or Atmospheric Plasma Spray	
Microhardness	HV0.3	850 – 1300	
Macrohardness	HR15N	> 88	
Wear Rate	ASTM G65 B	< 8 mm^3	
Porosity		0.5 – 3 %	
Corrosion Resistance		Not recommended for corrosive media	
Maximum Service Temperature		500 °C	930 °F

[a] Depending on the HVOF spray gun used, parameter used and coating thickness applied.

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	
HVOF	**Atmospheric Plasma**
Water-cooled DiamondJet series	TriplexPro series
Air-cooled DiamondJet series	SinplexPro series
WokaJet series	Metco 9MBM
WokaStar series	Metco F4MB-XL series
JP5000	Metco 11MB

4 Commercial Information

4.1 Ordering Information and Availability

Product	Order No.	Package Size	Availability	Distribution
Amdry 9831	1001057	5 lb (approx. 2.25 kg)	Stock	Global
Diamalloy 2005NS	1000807	5 lb (approx. 2.25 kg)	Stock	Global
Metco 5143	1069645	10 lb (approx. 4.5 kg)	Stock	Global
Metco 73F-NS-1	1000304	5 lb (approx. 2.25 kg)	Stock	Global
Metco 73F-NS-1 (-45)	1093004	5 lb (approx. 2.25 kg)	Special Order	Global
Metco 73F-NS-2	1000449	5 lb (approx. 2.25 kg)	Stock	Global
	2264065	5 kg (approx. 11 lb)	Stock	Global
Metco 73SF-NS	1000308	5 lb (approx. 2.25 kg)	Stock	Global
Woka 3202	1041168	5 kg (approx. 11 lb)	Stock	Europe
	1041155	10 lb (approx. 4.5 kg)	Stock	Americas
Woka 3203	1041107	5 kg (approx. 11 lb)	Special Order	Global
Woka 3208	1035978	5 kg (approx. 11 lb)	Special Order	Global

Note: For products available in both kg and lb weights, the kg package will be supplied to unspecified regions (Africa, Asia/Pacific, Japan and Middle East) unless the lb package is specifically requested by the customer.

4.2 Handling Recommendations

- Store in the original container in a dry location.
- 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 correct SDS (Safety Data Sheet) for the product of interest 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.
Amdry 9831	50-330
Diamalloy 2005NS	50-330
Metco 5143	50-886
Metco 73F-NS-1	50-330
Metco 73F-NS-1 (-45)	50-330
Metco 73F-NS-2	50-330
Metco 73SF-NS	50-2049
Woka 3202	50-1991
Woka 3203	50-886
Woka 3208	50-886

Information is subject to change without prior notice.

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