

# Material Product Data Sheet

## Tungsten Carbide – 17% Cobalt Powders

**Thermal Spray Powder Products:** Amdry 9830, Amdry 9831, Diamalloy 2005NS, <sup>New!</sup> Metco 5143, Metco 73F-NS-1, Metco 73F-NS-2, Metco 73SF-NS, Woka 3201, Woka 3202, Woka 3203, Woka 3206, Woka 3207, Woka 3208, Woka 3223

### 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.

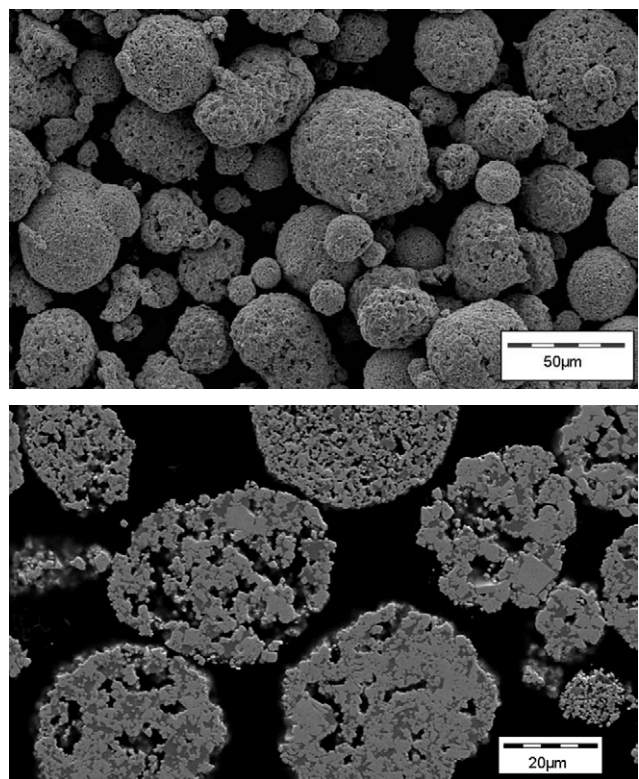
Coatings made from tungsten carbide-containing materials protect substrates from the effects of fretting, abrasive grains, particle erosion, sliding wear, hammer wear (impact resistance), cavitation and dynamic contact with hard surfaces. They can be used as an alternative for hard chromium plating when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

HVOF and APS (using a TriplexPro™ series gun) coatings of these materials are dense and show good bond strength.

#### 1.1 Typical Uses and Applications:

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

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



SEM Photomicrographs showing powder morphology (top) and microstructure (bottom).

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 <sup>3</sup>
Flowability	Free-flowing powder
Service Temperature	≤ 500 °C (930 °F)
Process	HVOF or atmospheric plasma spray

### 2 Material Information

#### 2.1 Chemical Composition

	Weight Percent (nominal)			
	Tungsten	Cobalt	Carbon (total)	Iron (max)
Amdry 9830	Balance	16.0 – 17.5	4.5 – 5.5	1.0
Amdry 9831	Balance	15.5 – 18.0	4.8 – 5.6	1.0
Diamalloy 2005NS	Balance	15.5 – 18.0	4.85 – 5.6	1.5
New! 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 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 3201	Balance	14.5 – 19.5	4.7 – 5.5	0.2
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 3206	Balance	14.5 – 19.5	4.7 – 5.5	0.2
Woka 3207	Balance	14.5 – 19.5	4.7 – 5.5	0.2
Woka 3208	Balance	14.5 – 19.5	4.7 – 5.5	0.2
Woka 3223	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 <sup>3</sup> )
Amdry 9830	-53 +20	Coarse	4.4 – 5.6
Amdry 9831	-53 +11	Coarse	4.3 – 5.9
Diamalloy 2005NS	-45 +5.5	Coarse	3.3 – 4.0
New! Metco 5143	-45 +15	Medium	3.7 – 4.1
Metco 73F-NS-1	-53 +11	Coarse	3.2 – 3.8
Metco 73F-NS-2	-53 +11	Coarse	2.7 – 4.0
Metco 73SF-NS	-38 +5.5	Medium	3.4 – 4.0
Woka 3201	-53 +20	Medium	4.4 – 5.1
Woka 3202	-45 +15	Medium	4.4 – 5.1
Woka 3203	-45 +11	Medium	4.4 – 5.1
Woka 3206	-53 +15	Medium	4.4 – 5.0
Woka 3207	-45 +20	Medium	4.4 – 5.1
Woka 3208	-90 +45	Medium	4.8 – 5.4
Woka 3223	-53 +11	Medium	4.6 – 5.2

- Particle size distribution: Analysis by sieve per ASTM B214 for all upper limits and lower limits for particle sizes  $\geq 20 \mu\text{m}$ . Lower limit analysis for particle sizes  $< 20 \mu\text{m}$  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.

### 2.3 Key Selection Criteria

- Select a material appropriate for the recommended spray process and spray gun to be used. (refer to Section 2.4).
- 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).
- New! • Metco 5143 is a cost-effective alternative to Diamalloy 2005, Amdry 9830, Amdry 9831 and Metco 73F series with improved deposit efficiency. It should be the material of choice for new aerospace applications. It can be certified to meet several specifications and fulfills the requirements for many more (refer to Section 2.6). Metco 5143 can be applied using the atmospheric plasma or HVOF spray processes.
- Amdry 9830 and Amdry 9831 are 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 2.4). It is recommended if thick coatings are necessary.
- Metco 73F-NS-1 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 than Metco 73FNS-1 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 to achieve coating 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 Recommended Spray Process and Spray Guns

	HVOF					APS
	Diamond Jet	WokaJet / WokaStar / JP5000	K2	Jet Kote	Top Gun / HV2000	TriplexPro / 9MB / F4, etc.
Amdry 9830						●
Amdry 9831						●
Diamalloy 2005NS	●					
New! Metco 5143	●	●	●	●	●	●
Metco 73F-NS-1						●
Metco 73F-NS-2						●
Metco 73SF-NS						●
Woka 3201		●	●	●		
Woka 3202	●	●			●	
Woka 3203	●					
Woka 3206		●	●			
Woka 3207	●	●				
Woka 3208						●
Woka 3223		●	●			

### 2.5 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, Sulzer Metco 5847 (see datasheet DSMTS-0025) or Woka 360x series products (see datasheet DSMTS-0051).
  - Chromium carbide materials such as Woka 71xx, Woka 72xx or Woka 73xx series products (see datasheets DSMTS-0027, DSMTS-0031 and DSMTS-0058, respectively).
- 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 (see datasheets DSMTS-0056, DSMTS-0059, respectively).
- 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 (see datasheets DSMTS-0027, DSMTS-0031 and DSMTS-0058, respectively).
- 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, Diamalloy 5847-1, Sulzer Metco 5847 (see datasheet DSMTS-0025) or Woka 360x series products (see datasheet DSMTS-0051).
  - A tungsten carbide cobalt material with a lower matrix content such as Woka 31xx series materials, Sulzer Metco 5810 or Sulzer Metco 5812 (see datasheet DSMTS-0044).

### 2.6 Customer Specifications

Product	Approved Specifications <sup>(1)</sup>	Fulfills Requirements <sup>(2)</sup>
Amdry 9830	Chromalloy BZ-003 Type 59 GE B50TF167, CI C Turbomeca LA 657 Ed. 2 PL2 Ind 0	
Amdry 9831	GE B50TF167, CI A 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 3.1.1) GE B50TF167, CI A Goodrich LGMS 9011 Type I Pratt & Whitney PWA 36331-2 Rolls-Royce Corporation EMS 39660 Rolls-Royce OMAT 3/237 Rolls-Royce plc MSRR 9507/69 Sumitomo SMM-904 Volvo PM 0026 Volvo PM 819-63 Williams CWIMS 795	
New! Metco 5143	SAE International AMS 7881	Boeing BMS 10-67 Type 1 CFM International CP 6004 Chemtronics OP Man. 5.4.3 de Havilland DHMS C4.19 GE B50TF167 Class A and C Honeywell EMS 39660 Pratt and Whitney PWA36331-2 Rolls-Royce, plc MSRR 9507/69 SNECMA DMR 33-019 SNECMA DMR 33-501 Turbomeca LA 657 Volvo PM 819-52 Volvo PM 819-63
Metco 73F-NS-1	Avio 4800M/15 CFM International CP 6004 Chemtronics OPS Man. 5.4.3 Chromalloy BZ-003 Type 59 GE B50TF167, CI A Honeywell M3975 Sneema DMR 33.019 Sneema DMR 33.501 Volvo PM 819-52	
Metco 73F-NS-2	Lucas Aerospace LA-M-093 Rolls-Royce OMAT 3/114C Rolls-Royce plc MSRR 9507/1	
Metco 73SF-NS	Industria de Turbo Propulsores SMM-926 Rolls-Royce plc MSRR 9507/42 Volvo PM 819-80	
WOKA 3223	Bombardier BAMS 561-001 Type 1	

1) Sulzer Metco can provide certification that the product meets these approved specifications

2) Material fulfils these specifications but is not approved for certification

### 3 Coating Information

#### 3.1 Key Thermal Spray Coating Information

Specification	Typical Data <sup>(1)</sup>
Recommended Spray Process	HVOF or Atmospheric Plasma Spray
Microhardness (HV0.3)	850 – 1300
Macrohardness (HR15N)	> 88
Wear Rate (ASTM G65 B)	< 8 mm <sup>3</sup>
Porosity	0.5 – 3 %
Corrosion Resistance	Not recommended for corrosive media
Maximum Service Temperature	500 °C <span style="float: right;">930 °F</span>

1) Depending on the HVOF spray gun used, parameter used and coating thickness applied.

#### 3.2 Available Coating Parameter Sheets:

Coating parameters for the following spray guns are available to Sulzer Metco customers. Please contact your local Sulzer Metco Account Representative. Please note that parameters may not be available for all guns

listed for each material. Support for specific application requirements are available through Sulzer Metco Coating Solutions Centers.

##### HVOF Spray Guns:

- Water-cooled DiamondJet series guns
- Air-cooled DiamondJet series guns
- WokaJet series guns
- WokaStar series guns
- JP5000

##### APS Spray Guns:

- TriplexPro series guns
- 9MB series guns
- F4 series guns
- 11MB

### 4 Commercial Information

#### 4.1 Ordering Information and Availability

	Order No.	Package Size	Availability	Distribution
Amdry 9830	1001056	5 lb (approx. 2.25 kg)	Special Order	Global
Amdry 9831	1001057	5 lb (approx. 2.25 kg)	Stock	Global
Diamalloy 2005NS	1000807	5 lb (approx. 2.25 kg)	Stock	Global
New! 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-2	1000449	5 lb (approx. 2.25 kg)	Stock	Global
Metco 73SF-NS	1000308	5 lb (approx. 2.25 kg)	Stock	Global
Woka 3201	1041106	5 kg (approx. 11 lb)	Special Order	Europe
	1041060	10 lb (approx. 4.5 kg)	Special Order	Americas
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)	Stock	Europe
	1041061	10 lb (approx. 4.5 kg)	Stock	Americas
Woka 3206	1041108	5 kg (approx. 11 lb)	Special Order	Europe
	1041062	10 lb (approx. 4.5 kg)	Special Order	Americas
Woka 3207	1041368	5 kg (approx. 11 lb)	Special Order	Europe
	1041327	10 lb (approx. 4.5 kg)	Special Order	Americas
Woka 3208	1035978	5 kg (approx. 11 lb)	Special Order	Europe
	1042910	10 lb (approx. 4.5 kg)	Special Order	Americas
Woka 3223	1063536	5 kg (approx. 11 lb)	Special Order	Europe
	1061273	10 lb (approx. 4.5 kg)	Special Order	Americas

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 MSDS (Materials Safety Data Sheet) for the product of interest localized for the country where the material will be used. MSDS are available from the Sulzer Metco web site at [www.sulzermetco.com](http://www.sulzermetco.com).

	MSDS No.
Amdry 9830	50-330
Amdry 9831	50-330
Diamalloy 2005NS	50-330
New! Metco 5143	50-886
Metco 73F-NS-1	50-330
Metco 73F-NS-2	50-330
Metco 73SF-NS	50-330
Woka 3201	50-886
Woka 3202	50-886
Woka 3203	50-886
Woka 3206	50-886
Woka 3207	50-886
Woka 3208	50-886
Woka 3223	50-886