

Material Product Data Sheet

Tungsten Carbide – 12 % Cobalt Fused (Cast) and Crushed Powders for Thermal Spray

Thermal Spray Powder Products:
Metco™ 71NS, Metco 71VF-NS,
Metco 71VF-NS-1, Diamalloy™ 2003

1 Introduction

Tungsten carbide cobalt fused and crushed powders are most commonly applied using the atmospheric plasma spray (including high-energy plasma) or HVOF processes. The coatings produced are dense and resistant to fretting wear (no intended sliding motion) for use at temperatures below 500 °C (930 °F). These coatings have good abrasive wear resistance and excellent erosion resistance.

Powders with finer particle sizes can be sprayed to produce a smooth as-sprayed finish that can reduce or eliminate the need for finishing operations. When finishing is necessary, the coatings should always be ground.

Due to the significant presence of the W_2C phase, these materials are sometimes referred to as “low carbon” carbide materials. Dissolution of this phase often causes matrix hardening and improved erosion resistance.

Compared to coatings of tungsten carbide – 17 wt.% cobalt, the reduced matrix content leads to coatings that are less ductile with higher hardness and better resistance to fretting and abrasion.

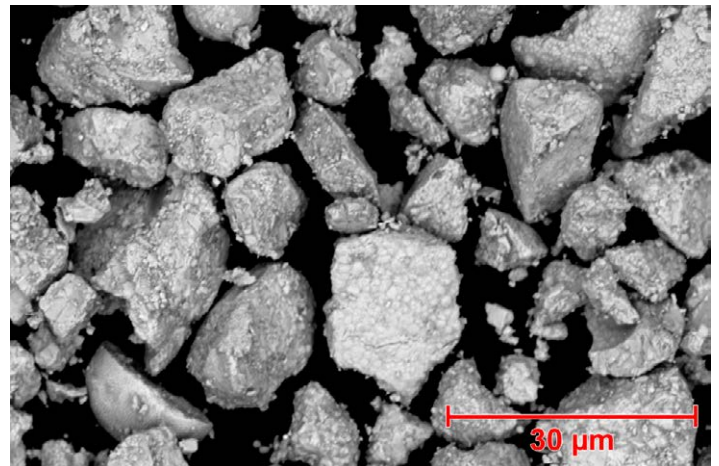
1.1 Typical Uses and Applications

Typical applications include:

- Aircraft flap tracks
- Expansion joints
- Compressor air seals
- Compressor stator snap diameters
- Fan blade midspan supports
- Cylinder liners

Quick Facts

Classification	Carbide, tungsten-based
Chemistry	88W ₂ C/WC 12Co
Manufacture	Fused and crushed
Morphology	Angular / blocky
Apparent Density	Approx. 6 g/cm ³
Purpose	Abrasive wear resistance
Melting Point	Approx. 1250 °C (2280 °F)
Service Temperature	≤ 500 °C (930 °F)
Process	HVOF or atmospheric plasma spray



SEM photomicrograph of Diamalloy 2003 showing the powder exterior morphology typical of these products.

2 Material Information

2.1 Chemical Composition

Product	Weight Percent (nominal)			
	W	Co	C _{TOTAL}	Fe
Metco 71NS	Bal.	11.0 – 13.0	3.6 – 4.2	NR
Metco 71VF-NS	Bal.	10.0 – 12.0	3.9 – 4.3	2.0 max
Metco 71VF-NS-1	80 min	10.0 – 12.0	3.9 – 4.3	2.0 max
Diamalloy 2003	80 min	10.0 – 12.0	3.9 – 4.3	2.0 max

NR = not reported

2.2 Particle Size Distribution

Product	Nominal Size Distribution (µm)
Metco 71NS	-90 +53
Metco 71VF-NS	-45 +5
Metco 71VF-NS-1	-45 +5
Diamalloy 2003	-38 +5

Particle size distribution: Analysis by sieve per ASTM B214 for all upper limits; values of 38 µm and lower based on laser scattering per ASTM C 1070 (Microtrac).

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).
- Choose the material that meets the required customer specifications, if necessary (refer to Section 2.6).
- These materials are extensively used and applied using atmospheric plasma spray or HVOF. Fine cuts can be used for high-energy plasma applications.

2.4 Related Products

- For a somewhat softer, more ductile matrix, choose a sintered and crushed tungsten carbide – 12% cobalt material such as Diamalloy 2004 or Metco 72F-NS (see datasheet DSMTS-0115).
- For better deposition efficiency, consider an agglomerated and sintered tungsten carbide – 12% cobalt material. Oerlikon Metco offers these materials in a variety of particle size distributions that are optimized for different spray processes and spray guns. (see datasheet DSMTS-0044).
- 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 (see datasheet DSMTS-0025),

Woka 360x series products (see datasheet DSMTS-0051), or Amdry 5843 and Diamalloy 5849 (see datasheet DSMTS-0113).

- 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, Metco 5847 (see datasheet DSMTS-0025) or Woka 360x series products (see datasheet DSMTS-0051).

2.5 Recommended Spray Process and Spray Guns

Product	HVOF	APS	
	DiamondJet	TriplexPro-200 /9MB / F4, etc.	
		Standard	High Energy
Metco 71NS		●	
Metco 71VF-NS		●	●
Metco 71VF-NS-1		●	●
Diamalloy 2003	●		

2.6 Customer Specifications

Product	Customer Specifications
Metco 71NS	Canada Pratt & Whitney CPW 42* GKN Aerospace PM 819-02 Honeywell EMS 52432, CI IX Pratt & Whitney PWA 1302 Snecma DMR 33.033
Metco 71VF-NS	Boeing BMS 10-67 Type I Boeing DMS 2049 Type II GKN Aerospace PM 819-01 MTU MTS 1247 Rolls-Royce plc MSRR 9507/41 SAE International AMS 7879
Metco 71VF-NS-1	GKN Aerospace PM 819-53 Pratt & Whitney PWA 1301 SAE International AMS 7879

* meets requirements of the specification, but not approved.

3 Coating Information

3.1 Key Thermal Spray Coating Information

Specification	Typical Data	
Recommended Spray Process	HVOF or Atmospheric Plasma Spray	
Corrosion Resistance	Not recommended for corrosive media	
Finishing	Diamond grind	
Maximum Service Temperature	500 °C	930 °F

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
DiamondJet series	Metco 9MB series
WokaJet series	Metco F4 series
WokaStar series	TriplexPro series

4 Commercial Information

4.1 Ordering Information and Availability

Product	Order No.	Package Size	Availability	Distribution
Metco 71NS	1000075	5 lb (approx. 2.25 kg)	Stock	Global
Metco 71VF-NS	1000084	5 lb (approx. 2.25 kg)	Stock	Global
Metco 71VF-NS-1	1000434	5 lb (approx. 2.25 kg)	Stock	Global
Diamalloy 2003	1000789	5 lb (approx. 2.25 kg)	Special Order	Global

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 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 Index No.
Metco 71NS	50-128
Metco 71VF-NS	50-2050
Metco 71VF-NS-1	50-128
Diamalloy 2003	50-2050

Information is subject to change without prior notice.