

Material Product Data Sheet

Tungsten Carbide – 17 % Nickel Powders

Thermal Spray Powder Products:

**Woka 3501, Woka 3502, Woka 3503, Woka 3505,
Woka 3506, Woka 3534**

1 Introduction

Woka™ 3500 products are spheroidal, agglomerated and sintered powders for thermal spray containing a uniform distribution of 83 % tungsten carbide with medium sized carbide grains as a hard phase and 17 % nickel as a binder metal. The finer powder particle size distributions produce very tough and dense coatings that can often be used in the “as-sprayed” condition without post-coat finishing.

Coatings made from tungsten carbide materials resist fretting, abrasion, hammer and sliding wear. Woka 3500 series products are most often used for abrasion-resistant coatings in dry environments. Their use at temperatures above 500 °C (930 °F) or in corrosive media is not recommended; although WC-Ni coatings have better corrosion resistance than WC-Co coatings in similar environments. In addition, they are not as hard as WC-Co coatings, but exhibit better toughness and they can be used in radioactive environments where the use of cobalt is prohibited.

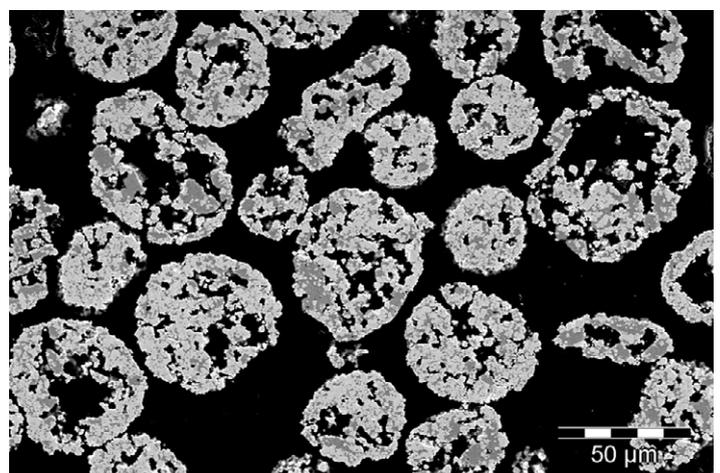
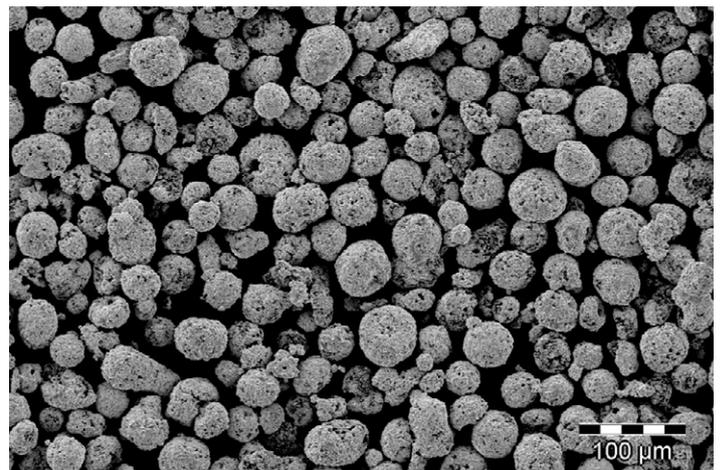
HVOF coatings of these materials are dense, show good bond strength and are more homogeneous than coatings applied using atmospheric plasma spray or combustion powder Thermospray™ coatings.

1.1 Typical Uses and Applications

- Parts requiring smooth surface textures
- Valve seats
- Parts used in submerged seawater conditions
- Oil field equipment where a tungsten carbide coating with better corrosion resistance is required

Quick Facts

Classification	Carbide, tungsten-based
Chemistry	WC 17Ni
Manufacture	Agglomerated and sintered
Morphology	Spheroidal
Carbide Size	Medium
Apparent Density	4.4 – 5.1 g/cm ³
Service Temperature	< 500 °C (930 °F)
Purpose	Wear resistance
Process	HVOF or atmospheric plasma spray



SEM Photomicrographs showing the morphology (top) and the microstructure (bottom) of a Woka 3500 Series Materials.

2 Material Information

2.1 Chemical Composition (all products)

Product	Weight Percent (nominal)			
	W	C	Ni	Fe
Woka 3500 Series	Balance	4.7 – 5.5	14.5 – 19.5	< 0.2

2.2 Particle Size Distribution

Product	Nominal Range μm	D95 μm	D5 μm	Primary Carbide Size μm
Woka 3501	-53 +20	53	20	Medium
Woka 3502	-45 +15	45	15	Medium
Woka 3503	-45 +11	45	11	Medium
Woka 3505	-38 +10	38	10	Medium
Woka 3506	-53 +15	53	15	Medium
Woka 3534	-106 +75	106	75	Medium

Size analysis below 20 μm using laser diffraction (Microtrac), Size analysis 20 μm and above using sieve. Other particle size distributions are available on request.

2.3 Key Selection Criteria

Main selection criteria for choosing a Woka 3500 series material are:

- Particle size distributions are optimized for a variety of HVOF guns on the market today. See Section 2.5 for recommendations.
- Desired as-sprayed surface roughness. For the smoothest possible surface, choose a product with the lowest particle size distribution appropriate for the spray process and spray gun to be used. In addition, finer carbides results in smoother as-sprayed coatings.

2.4 Related Products

- For applications where the service temperature is greater than 500 °C (930 °F) choose:
 - A chromium carbide, which can withstand service temperatures up to 870 °C (1600 °F), such as Woka 71xx, Woka 72xx or Woka 73xx series products (see datasheets DSMTS-0027, DSMTS-0031 and DSMTS-0058, respectively).
 - A material that contains both chromium carbide and tungsten carbide, such as Woka 75xx (see datasheet DSMTS-0056), which can withstand service temperatures up to 700 °C (1290 °F).
- For applications where a higher hardness, higher wear resistance or higher coating stiffness is required choose:
 - A tungsten carbide material with a cobalt-chromium matrix such as Woka 365x series products (see datasheet DSMTS-0025) or Woka 360x series products (see datasheet DSMTS-0051).
 - A chromium carbide material such as Woka 71xx, Woka 72xx or Woka 73xx series products (see datasheets DSMTS-0027, DSMTS-0031 and DSMTS-0058, respectively).
 - Tungsten carbide materials with a lower percentage of nickel matrix such as Woka 33xx series products (see datasheet DSMTS-0057).
- For better resistance in saline (NaCl), alkaline (NaOH), sulfuric acid (H₂SO₄) or acidic salt environments choose:
 - A tungsten carbide materials with a cobalt-chromium matrix such as Woka 365x series products (see datasheet DSMTS-0025) or Woka 360x series products (see datasheet DSMTS-0051).
 - 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).

2.5 Recommended Spray Guns

Product	Diamond Jet	WokaJet / WokaStar / JP5000	K2	Jet Kote	Top Gun / HV2000	CJS
Woka 3501		●	●			
Woka 3502	●	●	●	●		
Woka 3503	●				●	
Woka 3505	●				●	
Woka 3506		●		●		
Woka 3534						●

3 Coating Information

3.1 Key Thermal Spray Coating Information

Characteristic	Typical Data ^a	
Recommended Process	HVOF or Atmospheric Plasma Spray	
Microhardness	HV0.3	900 – 1200
Macrohardness	HR15N	> 90
Wear Rate	ASTM G65 B	< 12 mm ³ < 0.00061 in ³
Porosity	< 1%	
Corrosion Resistance	Better than WC 12Co coatings, but poor compared to WC 10Co 4Cr coatings	
Maximum Service Temperature	500 °C	930 °F
Deposition Efficiency	40 – 50%	

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

4 Commercial Information

4.1 Ordering Information and Availability

	Order No.	Package Size	Availability	Distribution
Woka 3501	1041638	5 kg (approx. 11 lb)	Special Order	Europe Americas
	1041586	10 lb (approx. 4.5 kg)		
Woka 3502	1064119	5 kg (approx. 11 lb)	Special Order	Europe
Woka 3503	1071044	5 kg (approx. 11 lb)	Special Order	Europe Americas
	1050288	10 lb (approx. 4.5 kg)		
Woka 3505	1068529	5 kg (approx. 11 lb)	Special Order	Europe
Woka 3506	1049660	10 lb (approx. 4.5 kg)	Special Order	Americas
Woka 3534	1042909	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 SDS 50-903 (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).