

# Material Product Data Sheet

## Tungsten Carbide – 10 % Nickel Powders

### Thermal Spray Powder Products:

**Woka 3301, Woka 3302, Woka 3303, Woka 3304, Woka 3305, Woka 3307, Woka 3309, Woka 3332**

### 1 Introduction

Woka 3300 products are spheroidal, agglomerated and sintered powders for thermal spray containing a uniform distribution of 90 % tungsten carbide with medium sized carbide grains as a hard phase and 10 % 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 3300 series products are most often used for abrasion-resistant coatings in dry environments. Their use at atmospheric temperatures above 500 °C (930 °F) is not recommended to prevent oxidation of the tungsten carbide. The corrosion resistance of WC-Ni is generally better than that of WC-Co coatings in similar environments, but not as good as coatings of WC-Co-Cr. Woka 3300 series coatings exhibit higher hardness compared to coatings of WC-17Ni (Woka 3500 series products), but have lower toughness. The absence of cobalt allows Woka 3300 series coatings to be used in radioactive environments.

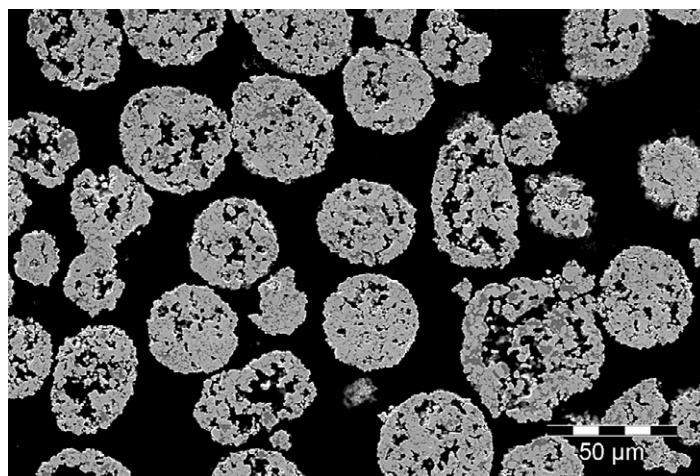
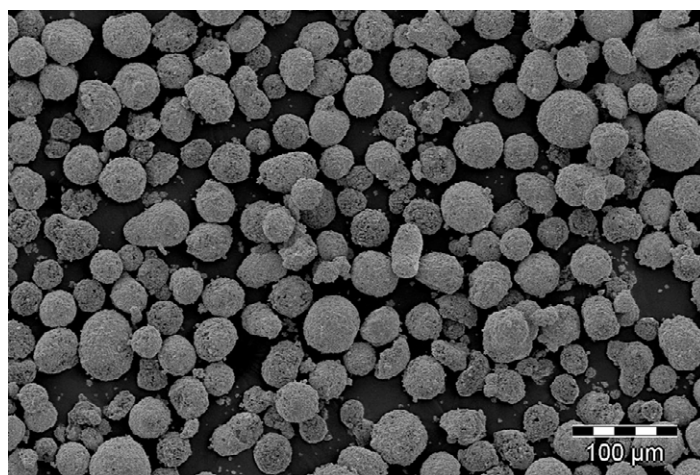
HVOF coatings of these materials are dense, show good bond strength and are more homogeneous than coatings applied using atmospheric plasma spray or combustion powder Thermospray™ coatings.

### 1.1 Typical Uses and Applications

- Ball valves in oxidizing environments
- Gate valves
- Oil field equipment
- Parts used in submerged seawater conditions

### Quick Facts

Classification	Carbide, tungsten-based
Chemistry	WC 10Ni
Manufacture	Agglomerated and sintered
Morphology	Spheroidal
Apparent Density	4.6 – 5.4 g/cm <sup>3</sup>
Service Temperature	< 500 °C (930 °F)
Purpose	Wear resistance
Process	HVOF



SEM Photomicrographs showing the morphology (top) and the microstructure (bottom) of Woka 3301 powder.

## 2 Material Information

### 2.1 Chemical Composition (all products)

Product	Weight Percent (nominal)			
	W	C	Ni	Fe
Woka 3300 Series	Balance	5.2 – 6.0	8.5 – 11.5	< 0.2

### 2.2 Particle Size Distribution

Product	Nominal Range $\mu\text{m}$	D95 $\mu\text{m}$	D5 $\mu\text{m}$	Primary Carbide Size $\mu\text{m}$
Woka 3301	–53 +20	53	20	Medium
Woka 3302	–45 +15	45	15	Medium
Woka 3303	–45 +11	45	11	Medium
Woka 3304	–30 +10	30	10	Medium
Woka 3305	–38 +10	38	10	Medium
Woka 3307	–45 +20	45	20	Medium
Woka 3309	–45 +5	45	5	Medium
Woka 3332	–30 +5	30	5	Medium

Size analysis below 20  $\mu\text{m}$  using laser diffraction (Microtrac), Size analysis 20  $\mu\text{m}$  and above using sieve.  
Other particle size distributions are available on request.

### 2.3 Key Selection Criteria

Main selection criteria for choosing a Woka 7100 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 particle size fractions lead to finer as-sprayed surfaces.

### 2.4 Related Products

- Like Woka 33xx products, Woka 34xx series [WC 12Ni] and Woka 35xx series [WC 17Ni] products are also tungsten carbide materials with nickel as the binder matrix instead of cobalt. Coatings are resistant to fretting under impact and frictional loads at service temperatures up to 500 °C (930 °F). They show lower hardness, but better ductility than Woka 33xx series coatings and can also be used in radioactive environments.
- Metco 5810, Diamalloy 2004 and Woka 31xx series products [WC 12Co, spheroidal, agglomerated and sintered] produce coatings with higher hardness and wear-resistance compared to Woka 33xx products.

Applications include exhaust fans, pump housings and steel rolls.

- Metco 5143, Diamalloy 2005NS and Woka 32xx series products [WC 17Co spheroidal, agglomerated and sintered] produce coatings that are tougher and more fret-resistant than coatings of Woka 33xx series products as a result of their higher metallic binder content. Applications include landing gears, mid-span stiffeners, extrusion dies and sucker rod couplings. These materials are not recommended for use in corrosive media.
- When higher hardness, wear-resistance and corrosion resistance is required than provided by coatings of Woka 33xx series materials, choose products such as Woka 365x series and Metco 5847 [WC 10Co 4Cr spheroidal, agglomerated and sintered] or Woka 360x series materials [WC 9Co 5Cr 1Ni]. They are ideal materials for hard chrome replacement.
- Woka 75xx series products [Cr<sub>3</sub>C<sub>2</sub> 37WC 18 metal alloy] are materials with a mixture of chrome and tungsten carbide in a metal alloy matrix. The coatings exhibit higher hardness, better abrasion resistance and very good corrosion resistance in harsh environments with complex corrosive media. Coatings can be used at service temperatures up to 700 °C (1290 °F).

## 2.5 Recommended Spray Guns

Product	Diamond Jet	WokaJet / WokaStar / JP5000	K2	Jet Kote	Top Gun / HV2000	CJS
Woka 3301		●	●			
Woka 3302	●	●	●	●		
Woka 3303	●				●	
Woka 3304	●					●
Woka 3305	●				●	
Woka 3307	●	●		●		
Woka 3309	●				●	
Woka 3332	●					●

## 3 Coating Information

### 3.1 Key Thermal Spray Coating Information

Characteristic	Typical Data <sup>a</sup>
Recommended Process	HVOF
Microhardness HV0.3	1000 – 1250
Macrohardness HR15N	> 90
Wear Rate ASTM G65 B	< 6.5 mm <sup>3</sup> < 0.0004 in <sup>3</sup>
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	35 – 50 %

<sup>a</sup> Depending on the HVOF spray gun used, spray parameters 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 HVOF Spray Guns

DiamondJet series  
WokaJet series  
WokaStar series

## 4 Commercial Information

### 4.1 Ordering Information and Availability

Product	Order No.	Package Size	Availability	Distribution
Woka 3301	1041110	5 kg (approx. 11 lb)	Special Order	Europe
	1041064	10 lb (approx. 4.5 kg)	Special Order	Americas
Woka 3302	1041111	5 kg (approx. 11 lb)	Stock	Europe
	1064379	25 kg (approx. 55 lb)	Special Order	Europe
	1041065	10 lb (approx. 4.5 kg)	Special Order	Americas
Woka 3303	1041148	5 kg (approx. 11 lb)	Special Order	Europe
	1041183	10 lb (approx. 4.5 kg)	Special Order	Americas
Woka 3304	1049842	10 lb (approx. 4.5 kg)	Special Order	Americas
Woka 3305	1063539	5 kg (approx. 11 lb)	Special Order	Europe
Woka 3307	1063540	5 kg (approx. 11 lb)	Special Order	Europe
	1050650	10 lb (approx. 4.5 kg)	Special Order	Americas
Woka 3309	1058975	10 lb (approx. 4.5 kg)	Special Order	Americas
Woka 3332	1049840	10 lb (approx. 4.5 kg)	Special Order	Americas

Note: For products available in both kilogram and pound weights, the kilogram package will be supplied to unspecified regions (Africa, Asia/Pacific, Japan and Middle East) unless the pound 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 50-885 (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](http://www.oerlikon.com/metco) (Resources – Safety Data Sheets).