

# Material Product Data Sheet

## Tungsten Carbide 9% Cobalt 5% Chromium 1% Nickel

### Powder Products:

**Woka 3602, Woka 3603, Woka 3604, Woka 3622**

### 1 Introduction

Woka™ 3600 series products are agglomerated and sintered powders for thermal spray that contain 85 % tungsten carbide as a hard phase material and a cobalt-chromium-nickel matrix, which functions as a binder for the carbide particles. The particle shape is primarily spheroidal.

These materials can be applied using the HVOF process whenever extremely wear-resistant coatings are required for low temperature applications in corrosive mediums, such as mining rollers of carrier belts. Coatings are thermally stable up to a maximum of 500 °C (930 °F). Products with finer particle distributions produce very tough and dense coatings that can often be used in the “as-sprayed” condition without further finishing.

HVOF coatings of these materials are dense and show good bond strength.

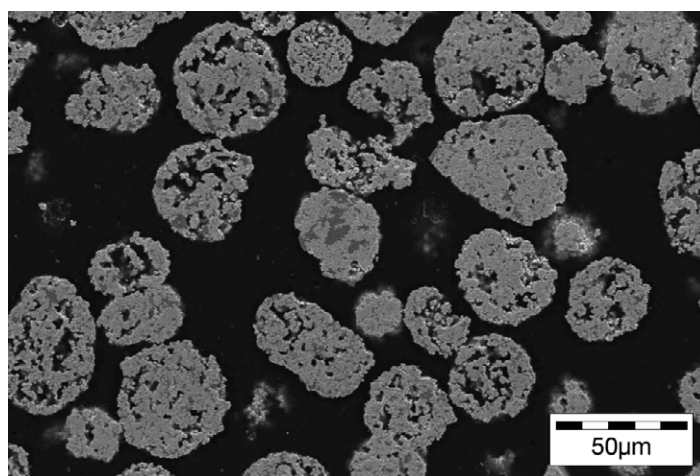
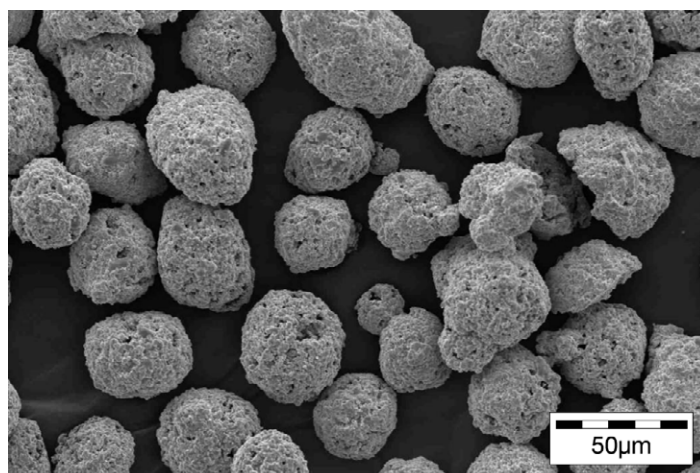
#### 1.1 Typical Uses and Applications

Woka 3600 series materials are the best choice whenever corrosion-resistant coatings, coupled with high abrasion resistance, are needed. Corrosion resistance equals or surpasses galvanic chromium plating, especially in HCl environments. Typical applications include:

- Carrier belt rollers
- Paper machinery rolls
- Pump seals
- Slush pump piston rods
- Dump valves
- Hydraulic rods
- Polished rod liners
- Thermal sprayed alternative to hard chromium plating

### Quick Facts

Classification	Carbide, tungsten-based
Chemistry	85WC 9Co 5Cr 1Ni
Manufacture	Agglomerated and sintered
Morphology	Spheroidal
Purpose	Corrosive wear resistance
Apparent Density	4.5 – 5.4 g/cm <sup>3</sup>
Flowability	Free-flowing powder
Service Temperature	≤ 500 °C (930 °F)
Process	HVOF



SEM Photomicrographs showing powder morphology (top) and microstructure (bottom) of Woka 3607 powder.

## 2 Material Information

### 2.1 Chemical Composition

	Weight Percent (nominal)					
	W	Co	Cr	Ni	C (total)	Fe (max)
Woka 3600 Series (all products)	Balance	7.5 – 10.5	4.4 – 5.6	0.5 – 1.5	4.8 – 5.6	0.2

### 2.2 Particle Size Distribution and Apparent Density

	Nominal Range (µm)	Primary Carbide Grain Size	Apparent Density (g/cm <sup>3</sup> )
Woka 3602	-45 +15	Medium	4.7 – 5.3
Woka 3603	-45 +11	Medium	4.7 – 5.3
Woka 3604	-30 +10	Medium	4.5 – 5.1
Woka 3622	-25 +10	Medium	4.5 – 5.1

- 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 size distributions available on request.

### 2.3 Key Selection Criteria

- Choose a product for a specific application based on:
- The process and spray gun to be used (refer to Section 2.5).
- The desired as-sprayed surface roughness. For smoother surfaces, choose the lowest particle size distribution possible.

### 2.4 Related Products

- For better corrosion resistance in alkaline (NaOH), sulfuric acid (H<sub>2</sub>SO<sub>4</sub>) or saline (NaCl) solutions the following products are recommended:
- Chromium carbide materials such as Woka 71xx, Woka 72xx or Woka 73xx series products.
- Materials that contain both chromium carbide and tungsten carbide, such as Woka 75xx or Woka 37xx 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.

### 2.5 Recommended Spray Process and Spray Guns

	HVOF				
	DiamondJet	WokaJet / WokaStar / JP5000	K2	Top Gun / HV2000	CJS
Woka 3602	●	●	●	●	
Woka 3603	●				
Woka 3604	●				●
Woka 3622	●				

### 3 Coating Information

#### 3.1 Key Thermal Spray Coating Information

Specification	Typical Data <sup>a</sup>	
Recommended Process	HVOF	
Microhardness	HV0.3	1050 – 1400
Macrohardness	HR15N	> 92
Wear Rate	ASTM G65 B	< 4 mm <sup>3</sup>
Porosity	< 1 – 2 %	
Corrosion Resistance	Excellent in NaCl (1M), good in HCL (1M), H <sub>2</sub> SO <sub>4</sub> (0.5M) and NaOH (1M)	
Deposition Efficiency	32 – 52 %	
Maximum Service Temperature	500 °C	930 °F

<sup>1</sup> 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 HVOF Spray Guns

Water-cooled Diamond Jet

WokaJet series

WokaStar series

JP5000 (Praxair / Tafa)

### 4 Commercial Information

#### 4.1 Ordering Information and Availability

	Order No.	Package Size	Availability	Distribution
Woka 3602	1041112	5 kg (approx. 11 lb)	Stock	Global
Woka 3603	1041149	5 kg (approx. 11 lb)	Special Order	Europe
	1041184	10 lb (approx. 4.5 kg)	Stock	Americas
Woka 3604	1041113	5 kg (approx. 11 lb)	Stock	Global
Woka 3622	1041116	5 kg (approx. 11 lb)	Special Order	Global

Note: Packaging in kilograms will be supplied to unspecified regions (Africa, Asia/Pacific, Japan and Middle East) unless the packaging in pounds 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 50-872 (Safety Data Sheet) 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).

Information is subject to change without prior notice.