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Material Product Data Sheet
Chromium-Iron Carbide – 20 % Nickel Powder

Thermal Spray Powder Products:
Woka 7401, Woka 7402, Woka 7406

Note: Materials in this data sheet are proprietary to Caterpillar Inc. and are only sold to approved users.

1 Introduction

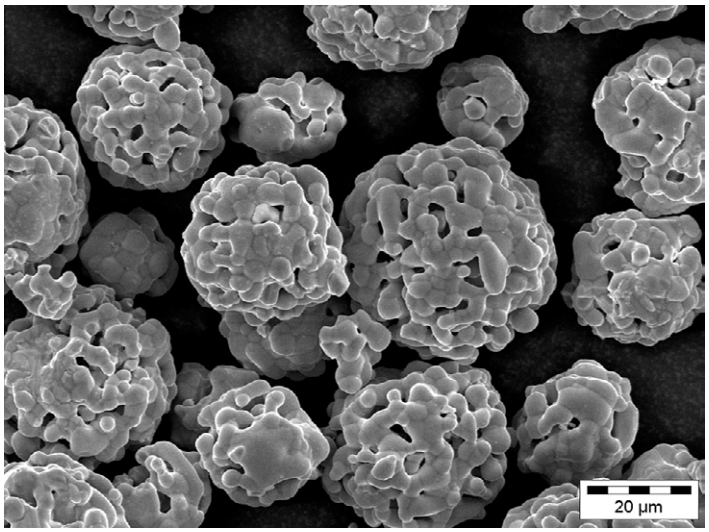
Compared to tungsten carbide materials, coatings of chromium carbide materials are often used at higher service temperatures. In the case of Woka 740X series products, service temperatures up to 750 °C (1380 °F) are possible.

Woka™ 740X series powders are spheroidal, agglomerated and sintered powders designed for thermal spray that contain 80 % chromium-iron carbide as the hard phase material and 20 % nickel matrix, which functions as a binder material for the carbides. This matrix is responsible for corrosion and oxidation resistance of Woka 740X coatings.

Coatings of chromium-iron carbide materials protect surfaces against abrasion, solid particle erosion (SPE) and tribocorrosion at room as well as elevated temperatures. Woka 740X materials were designed to produce coatings that can replace galvanic chromium plating with comparable corrosion resistance, hardness and wear resistance.

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

Quick Facts	
Classification	Carbide, chromium-based
Chemistry	$(CrFe)_7C_3$ 20Ni
Manufacture	Agglomerated and sintered
Morphology	Spheroidal
Apparent Density	2.3 – 3.0 g/cm^3
Flowability	Free-flowing
Service Temperature	< 750 °C (1380 °F)
Purpose	Corrosive wear resistance
Process	HVOF



SEM Photomicrograph showing the morphology of Woka 74XX series powders.

1.1 Typical Uses and Applications

Woka 740X series materials are cost-effective alternatives for chromium-carbide nickel-chromium powders. Woka 740X materials can be used in saline (NaCl) or alkaline (NaOH) environments 750 °C (1380 °F). Hydrochloric (HCl) or sulphuric (H_2SO_4) acid environments should be avoided.

Typical applications for Woka 740X materials include:

- Hydraulic cylinders
- Galvanic chromium plating replacement
- Hydraulic piston rods (i.e. for earth moving vehicles)
- Boiler coatings
- Bearing sleeves for truck applications

2 Material Information

2.1 Chemical Composition (all products)

Product	Weight Percent (nominal)			
	Cr	Fe	Ni	C_{TOTAL}
Woka 7400 Series	Balance	11.5 – 18.5	18.0 – 22.0	6.8 – 7.8

2.2 Particle Size Distribution

Product	Nominal Range µm	Primary Carbide Size µm	Apparent Density (g/cm^3)
Woka 7401	–53 +20	Coarse	2.4 – 3.0
Woka 7402	–45 +15	Coarse	2.3 – 2.9
Woka 7406	–53 +15	Coarse	2.3 – 2.9

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 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

- When service temperatures exceed 750 °C (1380 °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 abrasion resistance is required choose:
  - A tungsten carbide material with a cobalt-chromium matrix such as Woka 365x or Woka 360x series products (see datasheet DSMTS-0025 and DSMTS-0051, respectively).
  - 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).
- If better corrosion resistance for saline (NaCl) environments is required, choose:
  - A tungsten-carbide materials with a cobalt-chromium matrix such as Woka 365x or Woka 360x series products (see datasheet DSMTS-0025 and DSMTS-0051, respectively).
  - 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).
- For applications where higher hardness is needed or better corrosion resistance in sulfuric acid (H_2SO_4) or hydrochloric acid (HCl) environments choose:
  - A tungsten-carbide materials with a cobalt-chromium matrix such as Woka 365x or Woka 360x series products (see datasheet DSMTS-0025 and DSMTS-0051, respectively).
  - A chromium carbide 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).
  - 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 7401			●	●		
Woka 7402	●	●			●	
Woka 7406	●	●	●			●

3 Coating Information

3.1 Key Thermal Spray Coating Information

Characteristic		Typical Data [a]	
Recommended Process		HVOF	
Microhardness	HV0.3	850 – 1350	
Macrohardness	HR15N	> 88	
Wear Rate	ASTM G65 B	< 9 mm^3	< 0.00018 in^3
Porosity		< 1 – 1.5 %	
Corrosion Resistance		Excellent in NaOH (1M), good in NaCl (1M), poor in H_2SO_4 (0.5M) and HCl (1M)	
Maximum Service Temperature		750 °C	1380 °F
Deposition Efficiency		30 – 55 %	

[a] Depending on the 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 7401	1064601	10 lb (approx. 4.5 kg)	Special Order	Americas
Woka 7402	1059866 1059871	5 kg (approx. 11 lb) 10 lb (approx. 4.5 kg)	Special Order Special Order	Europe Americas
Woka 7406	10647895	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.
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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 50-973 (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).

Information is subject to change without prior notice.

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