

Material Product Data Sheet

Tungsten Carbide Cemented Sinter Pellets for Hard Face Applications

Powder Products:

**WOKA 50207, WOKA 50236, WOKA 50502,
WOKA 50503, WOKA 50504, WOKA 50505,
WOKA 50512, WOKA 50610, WOKA 50530,
WOKA 50532, WOKA 50538**

1 Introduction

WOKA™ Cemented Tungsten Carbide Pellets (CTCP) are spheroidal cemented carbide materials specially designed for hard-banding applications in the oil and gas industry. They are manufactured by agglomeration and sintering. In addition, some products are re-sintered to achieve a denser microstructure that exhibits very minimal porosity.

These products can be blended as a hard-phase filler material in nickel or iron hard facing rods and wires. Blend products with finer particle size distributions with cobalt-, iron- or nickel-based self-fluxing alloy powders using a hard phase to matrix ratio of 30 to 60 % for PTA or laser cladding applications. Products with finer particle size distributions are also appropriate for infiltration processing on PDC drill bits.

When PTA welding, phase transformation of these materials is very low, with no embrittlement of the matrix alloy, thereby producing crack-free deposits.

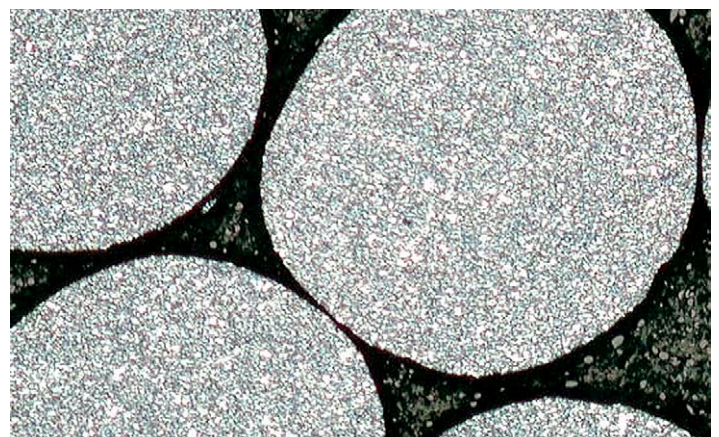
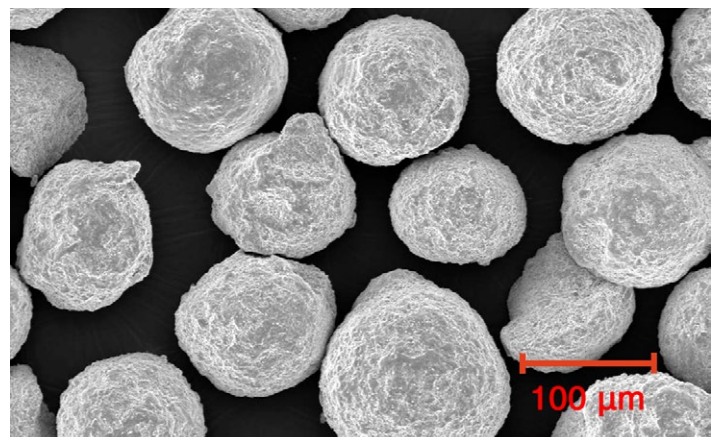
As hard phase materials, these products have a hardness of 1400 to 1600 HV0.1. CTCP has the highest impact resistance compared to all other types of tungsten carbide, and are especially recommended for very harsh applications to combat the combined effects of impact and abrasion. The finer particle sizes distributions offer good resistance to erosion and can be blended with coarser size distributions to enhance the erosion characteristics of the hard face overlay. Nickel compositions of the CTCP products offer better corrosion resistance than CTCP cobalt compositions.

1.1 Typical Uses and Applications:

- Construction equipment wear plates
- Agricultural plowshares or cultivator blades
- Oil and gas drill stabilizers and tool joints
- Carbide infiltration for oil and gas PDC drill bits
- Biomass and wood processing knives
- Heavy equipment chains and bearings

Quick Facts

Classification	Carbide, tungsten-based (CTCP)
Chemistry	WC 6Co or WC 6Ni
Manufacture	Agglomerated and sintered / dense sintered
Morphology	Spheroidal
Apparent Density	7.5 – 9.5 g/cm ³
Bulk Density	14.0 – 15.5 g/cm ³
Tap Density	9 – 11 g/cm ³
Hardness	1400 – 1600 HV0.1
Service Temperature	< 500 °C (930 °F)
Purpose	Hard phase blend component for wear and impact resistance
Process	Oxy-acetylene welding, spray and fuse powder welding, PTA, laser cladding



SEM photomicrographs. Top: exterior spheroidal morphology. Bottom: fully dense interior structure.

2 Material Information

2.1 Chemical Composition

Product	Chemical Composition (nominal wt.%)				
	W	Co	Ni	C	Total All Other
WOKA 50207	Balance	5.5 – 7.5	---	5.6 – 5.9	0.5 (max)
WOKA 50236	Balance	5.5 – 7.5	---	5.6 – 5.9	0.5 (max)
WOKA 50502	Balance	5.5 – 7.5	---	5.6 – 5.9	0.5 (max)
WOKA 50503	Balance	5.5 – 7.5	---	5.6 – 5.9	0.5 (max)
WOKA 50504	Balance	5.5 – 7.5	---	5.6 – 5.9	0.5 (max)
WOKA 50505	Balance	5.5 – 7.5	---	5.6 – 5.9	0.5 (max)
WOKA 50512	Balance	5.5 – 7.5	---	5.6 – 5.9	0.5 (max)
WOKA 50610	Balance	5.5 – 7.5	---	5.6 – 5.9	0.5 (max)
WOKA 50530	Balance	---	5.5 – 7.5	5.6 – 5.9	0.5 (max)
WOKA 50532	Balance	---	5.5 – 7.5	5.6 – 5.9	0.5 (max)
WOKA 50538	Balance	---	5.5 – 7.5	5.6 – 5.9	0.5 (max)

2.2 Particle Size Distribution, Manufacturing Method, Density and Former Product Designation

Product	Nominal Particle Size Distribution	Manufacturing Method ^a	Nominal Apparent Density Range (g/cm ³)	Former Product Designation (for reference)
WOKA 50207	-150 +63 µm	DS		
WOKA 50236	-1.4 +0.6 mm	AS		
WOKA 50502	-16 +20 mesh (-1.18 +0.85 mm)	AS		
WOKA 50503	-40 +60 mesh (-425 +250 µm)	AS		WOKA 9406-CoDS or WOKA WC6%Co Sinterpellets
WOKA 50504	-80 +200 mesh (-180 +75 µm)	DS		
WOKA 50505	-120 +200 mesh (-125 +75 µm)	DS	7.5 – 9.5	
WOKA 50512	-60 +120 mesh (-250 +125 µm)	DS		
WOKA 50610	-30 +40 mesh (-600 +425 µm)	AS		
WOKA 50530	-30 +40 mesh (-600 +425 µm)	AS		
WOKA 50532	-60 +120 mesh (-250 +125 µm)	DS		WOKA 9406-NiDS or WOKA WC6%Ni Sinterpellets
WOKA 50538	-80 +140 mesh (-180 +106 µm)	DS		

■ Particle size determination by sieve analysis in accordance with ASTM B214, including the use of this methodology for particle sizes above 850 µm

■ Other particle size distributions are available on request

^a **AS** = agglomerated and sintered; **DS** = agglomerated and sintered followed by a second sintering step to further densify the powder particles

2.3 Recommended Hardfacing Process

Product	Laser Cladding	PTA	Spray and Fuse Powder Welding	Oxy-Acetylene	GMAW (MIG)
WOKA 50207	☐	●			
WOKA 50236				●	
WOKA 50502				●	
WOKA 50503				●	●
WOKA 50504		●			●
WOKA 50505	●	☐	●		☐
WOKA 50512		☐			●
WOKA 50610				●	
WOKA 50530				●	
WOKA 50532		☐			
WOKA 50538		●			

● = Recommended process; ☐ = Acceptable process. See Section 2.4 for further information.

2.4 Key Selection Criteria

- All materials are agglomerated and sintered. However, materials designated as "DS" in Section 2.2 are further densified through a second sintering process. For particle size distributions of 250 µm and below, DS products are recommended when used for PTA and laser cladding to reduce the potential for dissolution during processing.
- WOKA 50504, WOKA 50207 and WOKA 50538 are the preferred choices for PTA processing.
- WOKA 50512 or WOKA 50532 can also be used for PTA when a coarser carbide size is desired.
- WOKA 50505 is the preferred choice for laser cladding
- WOKA 50207 can be used for laser cladding when a coarser carbide size is desired.
- WOKA 50505 can also be used for spray and fuse applications.
- Coarser size distributions of the standard agglomerated and sintered CTCP materials (AS) are recommended when further sintering occurs during hard face processing or as filler materials for rods used for oxy-acetylene welding. AS CTCP materials can be blended with DS CTCP materials and/or other types of hard phase materials in powder blends, rods or wires.

2.5 Related Products

- Oerlikon Metco offers a variety of other tungsten carbide products appropriate for use as blend materials. These include fused tungsten carbide (CTC), spheroidized fused tungsten carbide (CTC-S), sintered and crushed tungsten carbide (SCTC), monocrystalline tungsten carbide (MTC) and hard metal (HM) grit. Please review their respective datasheets for further information and their appropriate use for various surfacing processes.
- Oerlikon Metco also offers pure chromium carbide products that can be used as a blend materials for higher temperature applications, or when additional corrosion resistance is needed.
- In addition to blend materials, Oerlikon Metco offers a wide range of carbide-containing hard facing products for use with various processes. Please see the appropriate datasheet or contact your sales representative for more information. These products include:
 - Spray and fuse products applied using thermal spray processes that contain tungsten carbide with a nickel-based, self-fluxing alloy matrix, such as Metco 36C, Metco 31C-NS, Metco 32C, Metco 34F and WOKA 7703, among others.
 - Ready-to-use blends of carbide hard phase and self-fluxing matrix materials for PTA and laser cladding.
 - A variety of carbide-containing tubular rods for oxy-acetylene welding, as well as carbide-containing electrodes, wires and flexible rope for arc welding.

3 Coating Information

3.1 Key Overlay Characteristics

Characteristic

Microhardness	CTCP	HV0.1	1400 – 1600
Hardphase / Matrix Blend Ratio			30 to 60 %

- Overlays containing CTCP will have lower hardness compared to other tungsten carbide types, but the best resistance to impact combined with abrasion.
- Overlays produced using cobalt compositions of CTCP materials offer the best ductility and heat resistance compared to all other forms of tungsten carbide.
- Overlays produced using nickel compositions of CTCP materials offer improved corrosion resistance. During processing, these combinations exhibit the best ability to flow and the best bonding within the overlay.
- To achieve the most homogeneous and dense overlay structure possible, combine the CTCP with irregularly shaped carbides (such as CTC).

4 Commercial Information

4.1 Ordering Information and Availability

Product	Order No.	Package Size	Availability	Distribution
WOKA 50207	1071691	10 lb (approx. 4.5 kg)	Special Order	Global
WOKA 50236	1065585	5 kg (approx. 11 lb)	Special Order	Global
WOKA 50502	1059524	10 lb (approx. 4.5 kg)	Special Order	Global
WOKA 50503	1059526	10 lb (approx. 4.5 kg)	Special Order	Global
WOKA 50504	1059529	10 lb (approx. 4.5 kg)	Special Order	Global
WOKA 50505	1067530	10 lb (approx. 4.5 kg)	Stock	Global
WOKA 50512	1067531	10 lb (approx. 4.5 kg)	Stock	Global
WOKA 50610	1063121	10 lb (approx. 4.5 kg)	Special Order	Global
WOKA 50530	1072793	10 lb (approx. 4.5 kg)	Special Order	Global
WOKA 50532	1075038	10 lb (approx. 4.5 kg)	Special Order	Global
WOKA 50538	1072797	10 lb (approx. 4.5 kg)	Special Order	Global

4.2 Handling Recommendations

- Store in the original, closed container in a dry location.
- Opened containers should be stored in a drying oven to prevent moisture pickup
- Tumble contents prior to use to avoid separation.

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 No.
WOKA 50207	50-1016
WOKA 50236	50-1016
WOKA 50502	50-1016
WOKA 50503	50-1016
WOKA 50504	50-1016
WOKA 50505	50-905
WOKA 50512	50-905
WOKA 50610	50-1016
WOKA 50530	50-1191
WOKA 50532	50-1191
WOKA 50538	50-1191