

Material Product Data Sheet

Monocrystalline Tungsten Carbide Blend Materials for Hard Face Applications

Powder Products:

WOKA 50105, WOKA 50107, WOKA 50115, WOKA 50120, WOKA 50131

1 Introduction

WOKA™ Monocrystalline Tungsten Carbides (MTC) are fully carburized, mono tungsten carbides (WC) that are stoichiometric compounds with a consistent carbon content of approximately 6.1 wt. %. MTC particles are considerably more thermodynamically stable than fused tungsten carbides as a result of their specific composition and microstructure.

WOKA MTC materials are designed to be the hard phase constituent of a wear-resistant surface. Depending on the surfacing process, they can be blended with self-fluxing alloys or used a filler material for rods, electrodes or infiltration applications. Overlays containing these materials offer strong abrasive wear resistance and moderate impact resistance.

For lower heat input processes (oxy-acetylene welding, laser cladding), phase transformation does not occur in the molten metals during the fusing process, thus embrittlement of the matrix metal does not occur. Phase transformation in high-heat processes (PTA and arc welding), is very minimal with no embrittlement of the matrix alloy, thereby producing crack-free deposits.

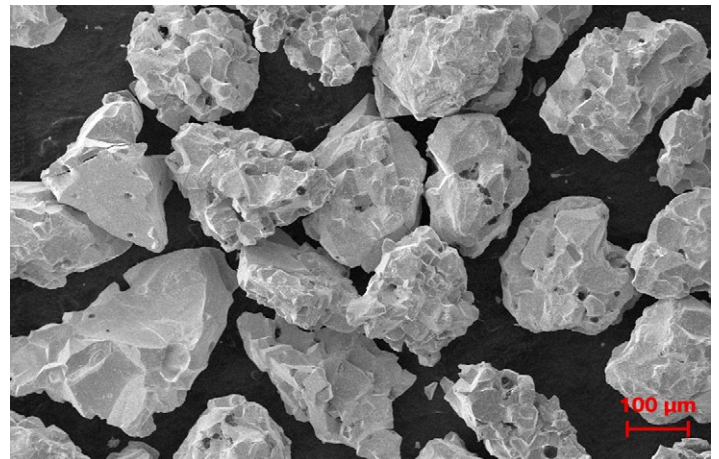
As hard phase materials, these products have a hardness of 1700 to 2000 HV0.1. MTC offers a good compromise of hardness versus sufficient ductility. MTC products are appropriate for many different applications with different wear conditions.

1.1 Typical Uses and Applications:

- Construction equipment wear plates
- Tunneling equipment
- Agricultural ploughshares, lifting shares or shear bars
- Oil and gas tool joints, PDC and steel body drill bits
- Biomass and wood processing knives and cutters
- Mining equipment crushers and milling machinery
- Heavy equipment mixer blades, decanters or extruder screws

Quick Facts

Classification	Carbide, tungsten-based (MTC)
Chemistry	WC
Manufacture	Carburized and crushed
Morphology	Blocky
Apparent Density	6 – 8 g/cm ³
Tap Density	7.5 – 8.5 g/cm ³
Bulk Density	14 – 15 g/cm ³
Hardness	1700 – 2000 HV0.1
Service Temperature	< 500 °C (930 °F)
Purpose	Hard phase blend component for wear resistance
Process	Oxy-acetylene welding, arc welding, PTA, laser cladding



SEM photomicrographs of WOKA MTC. top: morphology; bottom: inner structure.

2 Material Information

2.1 Chemical Composition

Product	Chemical Composition (nominal wt.%)		
	W	C	Total All Other
WOKA 50105	Balance	6.0 – 6.25	0.6 (max)
WOKA 50107	Balance	6.0 – 6.25	0.6 (max)
WOKA 50115	Balance	6.0 – 6.25	0.6 (max)
WOKA 50120	Balance	6.0 – 6.25	0.6 (max)
WOKA 50131	Balance	6.0 – 6.25	0.6 (max)

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

Product	Nominal Particle Size Distribution	Manufacturing Method	Nominal Apparent Density Range (g/cm ³)
WOKA 50105	-90 +45 µm	Carburized and crushed (MTC)	6 – 8
WOKA 50107	-150 +63 µm		
WOKA 50115	-180 +63 µm		
WOKA 50120	-180 +75 µm (-80 +200 mesh)		
WOKA 50131	-425 +250 µm		

- Particle size of 45 µm and below determined by laser diffraction (Microtrac), size above 45 µm determined by sieve analysis in accordance with ASTM B214
- Other particle size distributions are available on request

2.3 Recommended Hardfacing Process

Product	Laser Cladding	PTA	Spray and Fuse Powder Welding	Oxy-Acetylene	SMAW (MMA)	GMAW (MIG)	GTAW (TIG)
WOKA 50105	●		◐				
WOKA 50107	◐	●		●	●	◐	●
WOKA 50115	◐	●		●	●	◐	●
WOKA 50120	●	●		●	●	◐	●
WOKA 50131				●	●	●	

- = Recommended process; ◐ = Acceptable process. See Section 2.4 for further information.

2.4 Key Selection Criteria

- These are carburized and crushed powders that offer strong abrasive wear resistance and moderate impact resistance.
- MTC materials offer high resistance to dissolution; therefore, these products are usable in all arc processes, including products with finer particle size distributions.
- When using PTA or GMAW (MIG) processes, MTC may be the preferred carbide hard phase material. Deposits containing MTC are crack-free with high deposit hardness.
- For processes with lower heat input (oxy-acetylene welding and laser cladding), customers may find that other carbide types such as CTC or CTC-S are more suitable because of their higher hardness and better abrasion resistance.
- Finer particle size distributions of MTC materials are also suitable for infiltration processing for applications such as PDC drill bits.
- Coarser particle size distributions of MTC materials can be used for 'drop-in' (gravity fed) hard face welding.
- WOKA 50107, WOKA 50115 or WOKA 50120 are recommended for GTAW (TIG).
- WOKA 50107, WOKA 50115, WOKA 50120 or WOKA 50131 are recommended for oxy-acetylene welding or SMAW (MMA).
- WOKA 50131 is the best choice for GMAW (MIG).
- WOKA 50107, WOKA 50115 or WOKA 50120 can also be used for GMAW (MIG) when a finer size distribution is desired.
- WOKA 50105 or WOKA 50120 are the best choices for laser cladding.
- WOKA 50107 or WOKA 50115 can also be used for laser cladding.
- WOKA 50107, WOKA 50115 or WOKA 50120 are recommended for PTA applications.

2.5 Related Products

- Oerlikon Metco offers a variety of other tungsten carbide products appropriate for use as blend materials. These include spherical cast tungsten carbide (CTC-S), fused and crushed tungsten carbide (CTC), sintered and crushed tungsten carbide (SCTC), carbide sinter pellets (CTCP) 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	MTC	HV0.1	1700 – 2000	
Hardphase / Matrix Blend Ratio			30 to 70 %	

- Overlays containing MTC are highly suitable for abrasive wear protection and offer good impact resistance.
- MTC materials are resistant to dissolution during processing, resulting in hard, crack-free overlays when using cost and time effective technologies such as PTA, GTAW, GMAW or laser cladding.

4 Commercial Information

4.1 Ordering Information and Availability

Product	Order No.	Package Size	Availability	Distribution
WOKA 50105	1069726	25 kg (approx. 55 lb)	Special Order	Global
WOKA 50107	1068245	25 kg (approx. 55 lb)	Special Order	Global
WOKA 50115	1066404	5 kg (approx. 11 lb)	Special Order	Global
WOKA 50120	1063631	25 kg (approx. 55 lb)	Special Order	Global
WOKA 50131	1064507	5 kg (approx. 11 lb)	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 SDS 50-1467 (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).