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Material Product Data Sheet
Cast Tungsten Carbide / Nickel-Chromium Powders for Spray and Fuse Weld Hardfacing

PTA Powder Products:
WOKA 53025, WOKA 53045, WOKA 53114, WOKA 53134, WOKA 53164, WOKA 56006

1 Introduction

WOKA™ spray and fuse powder welding products are especially designed to be applied to create dense surface deposites with the highest abrasive wear resistance combined with good ductility and corrosion resistance.

These products have a nickel-based composite alloy matrix produced by gas atomization that are blended with cast tungsten carbide (CTC) having a fine acicular structure. The blend ratios and the composition of the matrix alloy vary with the product.

The CTC carbide constituent provides the abrasion resistance. The overall impact resistance depends on the blend ratio and hardness of the matrix alloy. The addition of silicon and boron into the matrix helps reduce the fusing temperature, which provides better carbide retention and reduced matrix embrittlement.

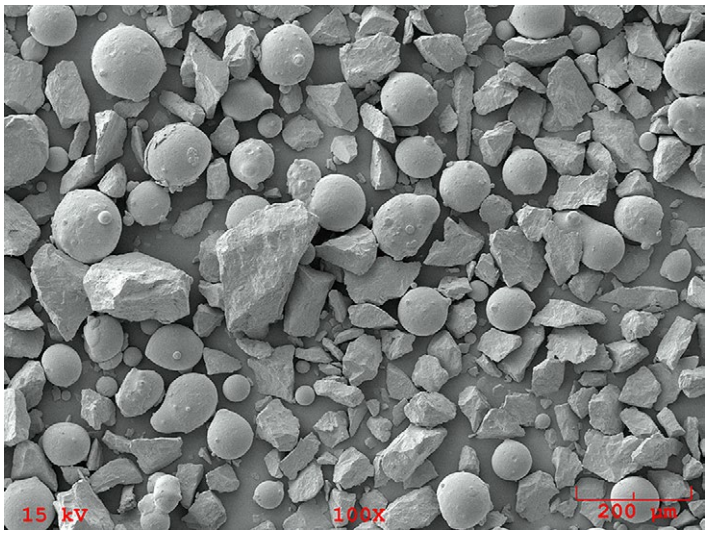
Compatible substrates that can be coated include mild steels, stainless steels and nickel-based alloys. Heat treatable steels having a complex geometry should be preheated to avoid cracking of the base metal. Overlays of these materials can be applied to external surfaces as well as internal bores.

1.1 Typical Uses and Applications:

Typical industries and applications include:

- Tailing pipelines (elbows)
- Decanter screws
- Mining equipment
- Petrochemical equipment
- Agricultural plowshares, lifting shares, harvester blades and shear bars
- Chipper knives
- Equipment for bulk material processing

Quick Facts	
Classification	Carbide, tungsten-based
Chemistry	CTC / NiCrBSi matrix
Manufacture	Blended (carbide: crushed / matrix: gas atomized)
Morphology	Carbide: angular Matrix: spheroidal
Carbide Hardness	2000 – 2300 HV0.1
Apparent Density	4.5 – 6.5 g/cm^3
Flowability	Free-flowing powder
Service Temperature	< 500 °C (930 °F)
Purpose	Wear resistance
Process	Spray and fuse powder welding, laser cladding, PTA



SEM photomicrograph showing the morphology of WOKA 53045 powder

2 Material Information

2.1 Chemical Composition

Product	Hard Phase Composition (wt.%)				Matrix Alloy Composition (wt.%)						
	Phase %	W	C	Fe	Phase %	Ni	Cr	Fe	B	Si	C
WOKA 53025	55	Bal.	3.8 – 4.1	< 0.30	45	Bal.	6.8 – 8.3	1.7 – 3.3	1.4 – 1.9	3.1 – 3.9	0.15 – 0.4
WOKA 53045	70	Bal.	3.8 – 4.1	< 0.30	30	Bal.	9.5 – 12.5	2.1 – 3.5	1.9 – 2.6	3.4 – 4.3	0.3 – 0.6
WOKA 53114	50	Bal.	3.8 – 4.1	< 0.30	50	Bal.	13.5 – 16.5	2.3 – 4.7	2.9 – 3.5	3.8 – 5.0	0.5 – 0.8
WOKA 53134	60	Bal.	3.8 – 4.1	< 0.30	40	Bal.	13.5 – 16.5	2.3 – 4.7	2.9 – 3.5	3.8 – 5.0	0.5 – 0.8
WOKA 53164	60	Bal.	3.8 – 4.1	< 0.30	40	Bal.	6.0 – 8.0	2.5 – 3.5	2.75 – 3.5	4.0 – 5.0	0.4 – 0.6
WOKA 56006	60	Bal.	3.8 – 4.1	< 0.30	40	Bal.	10.35 – 13.5	2.2 – 3.5	2.0 – 2.8	3.6 – 4.5	0.4 – 0.7

2.2 Particle Size Distribution and Former Product Designation

Product	Nominal Particle Size Distribution (µm)	Nominal Apparent Density Range (g/cm³)	Former Product Designation (for reference)
WOKA 53025	-150 +45	4.5 – 6.5	---
WOKA 53045	-150 +45	4.5 – 6.5	---
WOKA 53114	-106 +20	4.5 – 6.5	WOKA 6060
WOKA 53134	-106 +20	4.5 – 6.5	WOKA 6060
WOKA 53164	-106 +20	4.5 – 6.5	---
WOKA 56006	-125 +45	4.5 – 6.5	WOKA 6055

Measurement of upper particle size by sieve analysis; lower size analysis by laser difraction (Microtrac).
Other particle size distributions are available on request and can be tailored for specific on-site conditions and special applications.

2.3 Recommended Hardfacing Process

Product	Laser Cladding	PTA	Spray and Fuse Powder Welding
WOKA 53025			●
WOKA 53045			●
WOKA 53114			●
WOKA 53134			●
WOKA 53164			●
WOKA 56006	●	◖	●

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

2.4 Key Selection Criteria

- When a crack-free, highly impact resistant surface is needed, WOKA 53025 should be selected based on its tungsten carbide content and matrix alloy composition.
- WOKA 53045 contains significantly more carbide than WOKA 53025. Therefore, it should be selected for applications where erosion and/or abrasion resistance is the main concern, and fair impact resistance is sufficient.
- The matrix alloy used in WOKA 53045 contains slightly higher chromium content than the alloy used in WOKA 53025. If corrosion resistance is a requirement, WOKA 53045 may be a better candidate.
- Like Woka 53045, overlays of WOKA 53134 exhibit very good abrasive wear resistance. Because of its high matrix hardness and finer particle size distribution, it is usable to resist erosive and sliding wear conditions where there is little or no impact. Furthermore, overlays exhigit high corrosion resistance. The high boron and silicon content combined with its fine particle size distribution result in very good flowability.
- WOKA 53114 is similar to WOKA 53134 except it has a higher ratio of matrix alloy to hard phase. This results in more ductile overlays, but somewhat reduced abrasion and corrosion resistance.
- WOKA 53164 is an excellent choice to replace Eutalloy PE 1229 for decanter applications, steel body bits in oil and gas applications and agriculture parts.
- WOKA 53134 overlays exhibit a very good combination of high abrasion resistance and good impact resistance. Also, flowability is very good.
- WOKA 56006 can be used to create overlays using a variety of surface technologies, hence it is a choice with flexibility for the end user. It is very usable for laser cladding and spray and fuse powder welding, while acceptable for PTA hardfacing. Its composition and particle size distribution result in good abrasive wear resistance in combination with corrosion and impact resistance. It is possible to produce crack-free deposits using laser cladding or PTA processes.

2.5 Related Products

- Oerlikon Metco offers a wide variety of tungsten carbide wear resistant coating and hardface materials. Please refer to the appropriate materials guides for available choices.
- Spray and fuse products applied using thermal spray processes that contain tungsten carbide with a nickel-based, self-fluxing alloy matrix include: Metco 36C, Metco 31C-NS, Metco 32C, Metco 34F and WOKA 7703, among others. Please refer to datasheet DSMTS-0077 for more information.
- Nickel and cobalt-based spray and fuse products (without hard phase) applied using thermal spray processes include: Metco 12C, Metco 14E, Metco 15E and Metco 18C, among others. Please see datasheet DSMTS-0026 for more information.
- If thicker overlays are required, Oerlikon Metco offers a PTA welding powders, such as PlasmaDur 51022 and PlasmaDur 51027, which offer excellent abrasion resistance and fair impact resistance. Please refer to datasheet DSMW-0019.

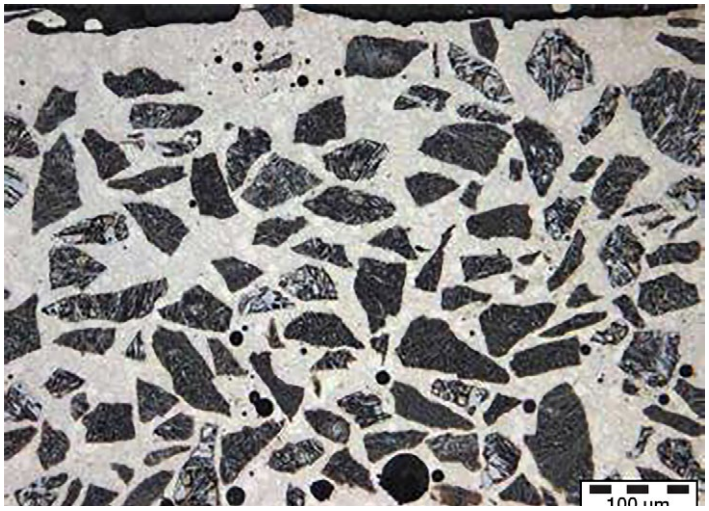
3 Coating Information

3.1 Key Overlay Characteristics

Product	Recommended Coating Process	Hard Phase (CTC) Microhardness HV0.1	Matrix Hardness HRC	Hard Phase / Matrix Blend Ratio	Thickness Limit [a] mm (in)
WOKA 53025	S&FPW	1900 – 2300	37 – 44	55 / 45	none
WOKA 53045	S&FPW		50 – 55	70 / 30	
WOKA 53114	S&FPW		57 – 63	50 / 50	
WOKA 53134	S&FPW		57 – 63	60 / 40	
WOKA 53164	S&FPW		45 – 50	60 / 40	
WOKA 56006	S&FPW, LC, PTA		50 – 55	60 / 40	

S&FPW = Spray and Fuse Powder Welding; **LC** = Laser Cladding; **PTA** = Plasma Transferred Arc
All values reported are nominal
[a] Thickness limitations are dependent on application parameters and hardware used
[b] For fusing

3.2 Typical Welding Overlay Cross Section



WOKA 53164 applied using spray and fuse powder welding.

3.3 Welding Parameters

Please contact your local Oerlikon Metco Account representative for the availability of starting process parameters. For specific application needs, Oerlikon Metco can provide parameter advice and parameter development services may be available.

4 Commercial Information

4.1 Ordering Information and Availability

Product	Order No.	Package Size	Availability	Distribution
WOKA 53025	1063637	10 kg (approx. 22.5 lb)	Special Order	Global
WOKA 53045	1063639	10 kg (approx. 22.5 lb)	Special Order*	Global
WOKA 53114	1065361	5 kg (approx. 11 lb)	Special Order	Global
WOKA 53134	1065453	5 kg (approx. 11 lb)	Special Order	Global
WOKA 53164	1065369	5 kg (approx. 11 lb)	Special Order	Global
WOKA 56006	1073483	5 kg (approx. 11 lb)	Special Order	Global

* WOKA 53045 is stocked in Canada

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 53025	50-1196
WOKA 53045	50-1197
WOKA 53114	50-1487
WOKA 53134	50-1496
WOKA 53164	50-1534
WOKA 56006	50-1500

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