

Material Product Data Sheet

Cast Tungsten Carbide / Nickel-Chromium Powders for Hardfacing Applications

PTA Powder Products:
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 deposits 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.

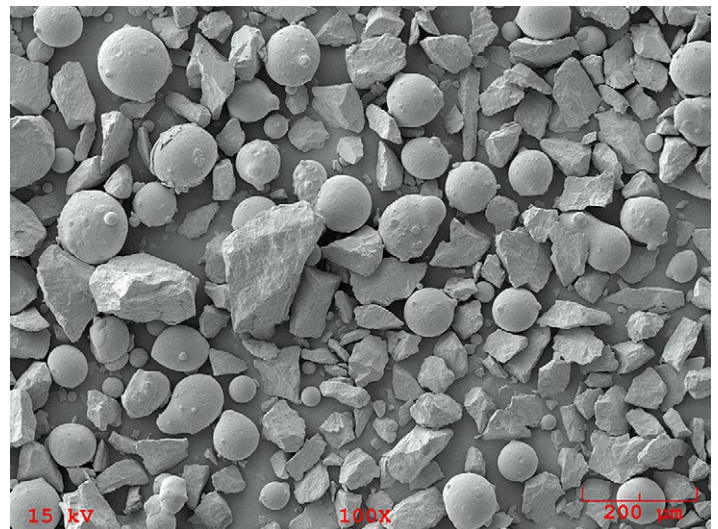
1.1 Typical Uses and Applications:

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
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 53114 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 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/cm ³)	Former Product Designation (for reference)
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 diffraction (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 ^a	Spray and Fuse Powder Welding
WOKA 53114	●	◐	●
WOKA 53134	●	◐	●
WOKA 53164	●	◐	●
WOKA 56006	●	◐	●

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

^a The higher heat input of the PTA process can result in more carbide dissolution than other processes

2.4 Key Selection Criteria

- 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 with little or no impact. Furthermore, overlays exhibit high corrosion resistance. The high boron and silicon content combined with its fine particle size distribution result in very good flow.
- 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, flow is very good.
- Use WOKA 56006 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

■ Metco Joining & Cladding offers a wide variety of tungsten carbide wear resistant coating and hardface materials. Please refer to the appropriate materials guides for available choices.

■ If thicker overlays are required, Metco Joining & Cladding offers a PTA welding powders, such as PlasmaDur 51022 and PlasmaDur 51027, which offer excellent abrasion resistance and fair impact resistance.

3 Coating Information

3.1 Key Overlay Characteristics

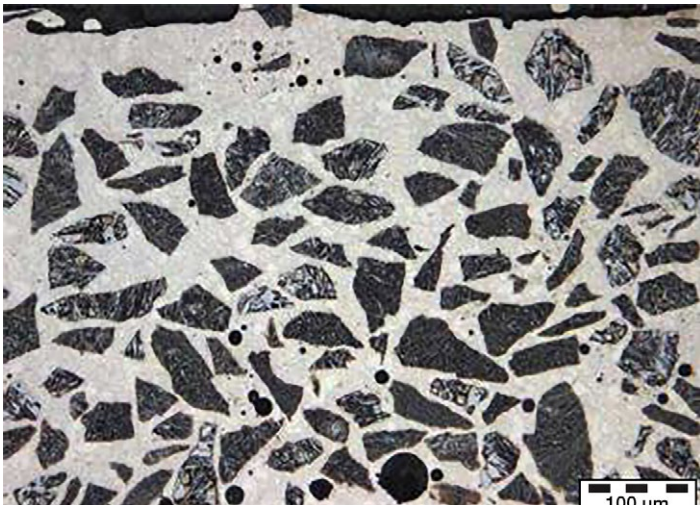
Product	Hard Phase (CTC) Microhardness HV0.1	Matrix Hardness HRC	Hard Phase / Matrix Blend Ratio	Thickness Limit ^a mm (in)
WOKA 53114	1900 – 2300	57 – 63	50 / 50	none
WOKA 53134		57 – 63	60 / 40	
WOKA 53164		45 – 50	60 / 40	
WOKA 56006		50 – 55	60 / 40	

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 Metco Joining & Cladding Account representative for the availability of starting process parameters. For specific application needs, Metco Joining & Cladding 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 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

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 Metco Joining & Cladding web site at www.metcojoiningcladding.com (Resources – Safety Data Sheets).

Product	SDS No.
WOKA 53114	50-1487
WOKA 53134	50-1496
WOKA 53164	50-1534
WOKA 56006	50-1500