

## Material Product Data Sheet

### Cast Tungsten Carbide / Nickel [Chromium] Boron Silicon Powders for Plasma Transferred Arc (PTA)

#### Powder Products:

**PlasmaDur 51021, PlasmaDur 51022, PlasmaDur 51027, PlasmaDur 51202, PlasmaDur 51222**

#### 1 Introduction

PlasmaDur™ 51021, PlasmaDur 51022 and PlasmaDur 51027 are blended powders of cast tungsten carbide (CTC) and a chromium-free, self-fluxing nickel-based alloy. Overlays of these materials offer good wear and impact resistance as a result of the tough matrix alloy.

PlasmaDur 51201 and PlasmaDur 51222 are blends of cast tungsten carbide (CTC) and a nickel-chromium self-fluxing alloy. Overlays of these materials offer very good wear resistance combined with corrosion resistance. Impact resistance is moderate.

The cast tungsten carbide particles are irregularly shaped, two-phase carbides that are produced by a melting process. This type of carbide has a hardness of 2000 to 2300 HV0.1. The matrix alloy is manufactured using gas atomization, and the particles exhibit a spheroidal shape. The powder compositions guarantee an uniform distribution of cast tungsten carbide within the matrix.

Hardface weld deposits applied using appropriate PTA welding parameters and with a matrix hardness below HRC 50 do not exhibit cracking.

#### 1.1 Typical Uses and Applications:

Typical industries and applications include:

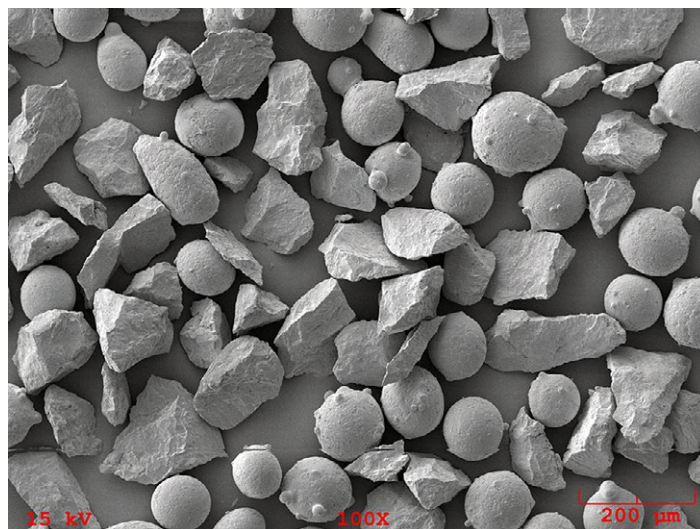
- Oil sand and lignite surface mining equipment
- Down hole tools for oil exploration
- Excavator buckets for earth moving equipment
- Extruder screws used for plastic manufacturing
- Agricultural shear bars, ploughshares or lifting shares

These materials can be used to coat substrates of:

- Mild steel
- Stainless steel
- Nickel alloys
- Heat-treatable steels when preheated to 300 °C (570 °F) to avoid extensive cracking in the overlay

#### Quick Facts

Classification	Carbide, tungsten-based
Chemistry	CTC / Ni[Cr]BSi matrix
Manufacture	Blended (carbide: crushed / matrix: gas atomized)
Morphology	Carbide: angular Matrix: spheroidal
Apparent Density	5.5 – 7.0 g/cm <sup>3</sup>
Flowability	Free-flowing powder
Service Temperature	< 500 °C (930 °F)
Purpose	Wear resistance
Process	PTA



SEM photomicrograph showing the morphology of PlasmaDur 51027 powder

## 2 Material Information

### 2.1 Chemical Composition

Product	Hard Phase Composition (wt.%)				Matrix Alloy Composition (wt.%)						
	Phase %	W	C	Fe	Phase %	Ni	Cr	B	Si	C	Fe
PlasmaDur 51021	60	Bal.	3.8 – 4.1	< 0.30	40	Bal.	---	2.8 – 3.2	2.7 – 3.3	< 0.03	< 0.30
PlasmaDur 51022	60	Bal.	3.8 – 4.1	< 0.30	40	Bal.	---	2.8 – 3.2	2.7 – 3.3	< 0.03	< 0.30
PlasmaDur 51027	60	Bal.	3.8 – 4.1	< 0.30	40	Bal.	---	2.8 – 3.2	2.7 – 3.3	< 0.03	< 0.30
PlasmaDur 51202	60	Bal.	3.8 – 4.1	< 0.30	40	Bal.	9.5 – 12.5	1.9 – 2.6	3.4 – 4.3	0.3 – 0.6	2.1 – 3.5
PlasmaDur 51222	60	Bal.	3.8 – 4.1	< 0.30	40	Bal.	13.5 – 16.5	2.9 – 3.6	3.8 – 5.0	0.5 – 0.8	2.3 – 4.7

### 2.2 Particle Size Distribution, Apparent Density and Former Product Designation

Product	Nominal Particle Size Distribution (µm)	Nominal Apparent Density Range (g/cm <sup>3</sup> )	Former Product Designation (for reference)
PlasmaDur 51021	-150 +53	5.5 – 7.0	WOKA 6040
PlasmaDur 51022	-180 +63	5.5 – 7.0	WOKA 6040
PlasmaDur 51027	-150 +63	5.5 – 7.0	WOKA 6040
PlasmaDur 51202	-180 +63	5.5 – 7.0	WOKA 6050
PlasmaDur 51222	-180 +63	5.5 – 7.0	WOKA 6060

Other particle size distributions are available on request and can be tailored for on-site conditions and special applications.

### 2.3 Key Selection Criteria

- PlasmaDur 51021, PlasmaDur 51022 and PlasmaDur 51027 weld overlays have a matrix hardness of approximately 50 HRC which provides very good abrasion wear resistance with good impact resistance. These products are often used in oil exploration and earth moving equipment, where high corrosion resistance is not required.
- PlasmaDur 51022 contains a coarser carbide size than PlasmaDur 51027, within the exact same matrix alloy.
- PlasmaDur 51021 is similar to PlasmaDur 51022 and PlasmaDur 51027, but with a particle size distribution that increases the product's apparent density, which improves its flowability and can produce denser overlays.
- PlasmaDur 51202 is a good choice for surfaces exposed to higher abrasive and erosive wear conditions where mild corrosion is a concern.
- PlasmaDur 51222 is quite good for abrasive and erosive wear conditions where impact is not a concern. Furthermore, its high chromium content results in overlays with better corrosion resistance.
- Due to the higher matrix hardness of PlasmaDur 51202 and PlasmaDur 51222, some cracking should be expected in overlays produced from these materials.

## 2.4 Related Products

- PlasmaDur 51122 also has a matrix hardness of approximately 50 HRC, but it is blended with a mono tungsten carbide (MTC), that is better suited for oil sand and lignite surface mining applications.
- PlasmaDur 51302 and PlasmaDur 51322 weld overlays produce the softest matrix macrohardness of approximately 30 HRC making them ideal for high impact and lower abrasion service conditions. These two materials have found great acceptance in the mining industry for classification screens and quarry equipment.
- PlasmaDur 51142 is a compromise between these products, with a hardface coating matrix hardness of approximately 40 HRC which provides good abrasion and reasonable impact resistance. Oil exploration and earthmoving equipment use this type of coating.
- Oerlikon Metco offers a wide variety of tungsten carbide wear-resistant coating materials. Please refer to our materials guides or contact your Oerlikon Metco Sales

Representative for more information on available material choices.

- Where spray and fuse applications suffice, WOKA 53025 and WOKA 53045 use fused tungsten carbide that provides very good abrasion resistance characteristics. WOKA 53025 shows excellent weldability producing a crack-free, highly impact resistant deposits while deposits made from WOKA 53045 exhibit high erosion resistance.
- Spray and fuse products that contain tungsten carbide with a nickel-based self-fluxing alloys matrix include Metco 36C, Metco 31C-NS, Metco 34F and WOKA 7703, among others. These materials are applied using thermal spray processes.
- Nickel- and cobalt-based self-fluxing alloys without hard phase that are thermal sprayed and subsequently fused materials include Metco 12C, Metco 14E, Metco 18C and other products. These materials form fully dense coatings with good corrosion resistance.

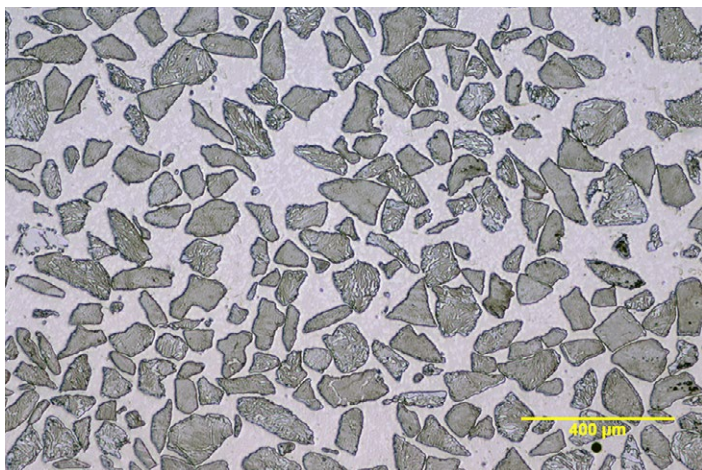
## 3 Coating Information

### 3.1 Key Overlay Characteristics

Characteristic			PlasmaDur 51021	PlasmaDur 51022	PlasmaDur 51027	PlasmaDur 51202	PlasmaDur 51222
Recommended Coating Process					Plasma Transferred Arc (PTA)		
Microhardness	CTC	HV0.1	2000 – 2300	2000 – 2300	2000 – 2300	2000 – 2300	2000 – 2300
Hardness	Matrix	HRC	48 – 54	48 – 54	48 – 54	48 – 54	57 – 63
Hardphase / Matrix Blend Ratio			60 / 40	60 / 40	60 / 40	60 / 40	60 / 40
Thickness	mm		none	none	none	6 – 8	3 – 4
	in					0.24 – 0.31	0.12 – 0.16

All values reported are nominal.  
Thickness limitations are dependent on application parameters and hardware.

### 3.2 Typical PTA Overlay Cross Section



PlasmaDur 51027

### 3.3 Welding Parameters

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

## 4 Commercial Information

### 4.1 Ordering Information and Availability

Product	Order No.	Package Size	Availability	Distribution
PlasmaDur 51021	1065364	25 kg (approx. 55 lb)	Special Order	Global
PlasmaDur 51022	1065366	25 kg (approx. 55 lb)	Special Order	Global
PlasmaDur 51027	1064397	25 kg (approx. 55 lb)	Special Order	Global
	1086174	5 kg (approx. 11 lb)	Special Order	Global
PlasmaDur 51202	1066837	5 kg (approx. 11 lb)	Special Order	Global
PlasmaDur 51222	1068383	5 kg (approx. 11 lb)	Special Order	Global

### 4.2 Handling Recommendations

- Store in the original, closed container in a dry location.
- Blend the entire contents of the container prior to use.

### 4.3 Safety Recommendations

See the SDS 50-911 (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](http://www.oerlikon.com/metco) (Resources – Safety Data Sheets).

Product	SDS No.
PlasmaDur 51021	50-911
PlasmaDur 51022	50-911
PlasmaDur 51027	50-911
PlasmaDur 51202	50-912
PlasmaDur 51222	50-912