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Material Product Data Sheet

Monocrystalline Tungsten Carbide / Nickel Chromium Boron Silicon Powder for Plasma Transferred Arc (PTA)

PTA Powder Products:
PlasmaDur 51122, PlasmaDur 51132, PlasmaDur 51142, PlasmaDur 51302, PlasmaDur 51322

1 Introduction

PlasmaDur™ powder materials presented herein contain crushed monocrystalline tungsten carbide (MTC), blended with a gas atomized, nickel-based self-fluxing alloy, designed to be used as a hardface overlay applied by Plasma Transferred Arc (PTA). Fully carburized MTC is a stoichiometric compound with a constant carbon content of 6.14 % by weight and has a stable single-phase microstructure.

The powder compositions ensure an even distribution of tungsten carbide within the metallic matrix, providing very good and even wear resistance (see photo, Section 3.2). Furthermore, there is virtually no dilution of the monocrystalline tungsten carbides during the welding process, resulting in no matrix metal embrittlement.

MTC has good wetability with nickel-based alloys during the PTA application process. The more thermodynamically stable MTC outperforms cast tungsten carbide thereby producing welds with high hardness in the range of HV0.1 1700 – 2000.

Depending on the chemistry of the nickel alloy matrix, these powders produce hardface coatings with varied abrasion and impact resistance properties. 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:

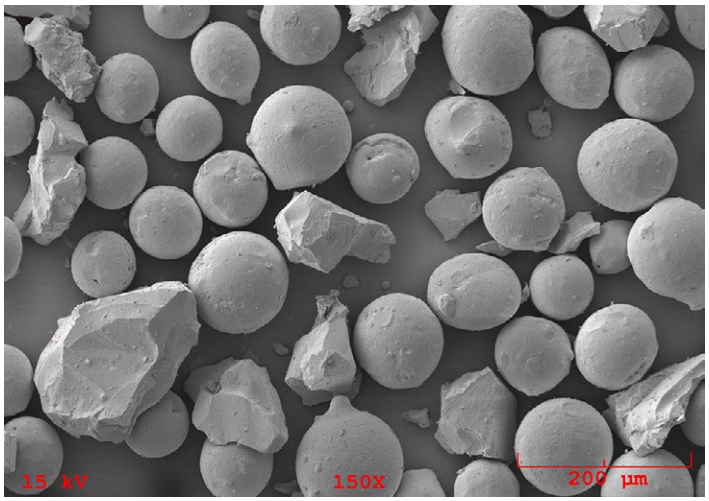
Typical industries and applications include:

- Mining equipment
- Petrochemical applications
- Earth moving equipment
- Food and chemical processing decanter screws

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	MTC / NiCrBSi matrix
Manufacture	Blended (carbide: crushed / matrix: gas atomized)
Morphology	Carbide: angular, Matrix: spheroidal
Apparent Density	5.0 – 6.5 g/cm^3
Flowability	Free-flowing powder
Service Temperature	< 500 °C (930 °F)
Purpose	Wear resistance
Process	PTA



SEM photomicrograph showing the morphology of PlasmaDur 51122 powder

2 Material Information

2.1 Chemical Composition

Product	Hard Phase Composition (wt. %)			Matrix Alloy Composition (wt. %)						
	Phase %	W	C	Phase %	Ni	Cr	B	Si	C	Fe
PlasmaDur 51122	60	93.8 – 94.0	6.0 – 6.2	40	Bal.	9.5 – 12.5	2.0 – 2.5	3.3 – 4.3	0.3 – 0.6	2.0 – 3.5
PlasmaDur 51132	60	93.8 – 94.0	6.0 – 6.2	40	Bal.	13.5 – 16.5	2.0 – 2.5	3.8 – 5.0	0.5 – 0.8	2.2 – 4.8
PlasmaDur 51142	60	93.8 – 94.0	6.0 – 6.2	40	Bal.	6.5 – 8.5	1.4 – 1.9	3.0 – 4.0	0.1 – 0.4	1.7 – 3.3
PlasmaDur 51302	65	93.8 – 94.0	6.0 – 6.2	35	Bal.	5.7 – 7.7	1.0 – 1.6	3.9 – 4.9	0.2 – 0.6	1.0 – 2.5
PlasmaDur 51322	60	93.8 – 94.0	6.0 – 6.2	40	Bal.	5.8 – 6.8	0.7 – 1.3	3.7 – 4.5	0.15 – 0.45	0.8 – 2.2

2.2 Particle Size Distribution, Apparent Density and Former Product Designation

Product	Nominal Particle Size Distribution (µm)	Nominal Apparent Density Range (g/cm^3)	Primary Carbide Grain Size	Former Product Designation (for reference)
PlasmaDur 51122	–180 +63	5.0 – 6.5	Coarse	WOKA 6050M
PlasmaDur 51132	–180 +63	5.0 – 6.6	Coarse	WOKA 6060M
PlasmaDur 51142	–180 +63	5.0 – 6.5	Coarse	WOKA 6040M
PlasmaDur 51302	–180 +63	5.0 – 6.5	Coarse	WOKA 6530M
PlasmaDur 51322	–180 +63	5.0 – 6.5	Coarse	WOKA 6030M

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 51302 and PlasmaDur 51322 weld overlays produce the softest matrix macrohardness of approximately HRC 30. This makes them ideally suited for conditions of high impact but lower abrasion. These materials have found excellent acceptance in the mining industry for classification screens and quarry equipment.
- PlasmaDur 51122 produce overlays with a matrix hardness of approximately HRC 50 which provides very good abrasive wear resistance but only fair impact resistance. This product is often used on oil exploration and earth moving equipment.
- PlasmaDur 51132 has a matrix hardness of approximately 60 HRC, which provides very good abrasive wear resistance but nearly no impact resistnce. This product can be used for wear plates exposed to harsh abrasive wear. Depending on the parameters used, it is possible to apply overlays without cracks based on reduced precipitation.
- PlasmaDur 51142 is a compromise compared to other products in this data sheet, with a hardface coating matrix hardness of approximately 40 HRC. This provides good abrasion and reasonable impact resistance. This material is often used in oil exploration and earth moving equipment.
- PlasmaDur 51302 contains 5 % more MTC than the other products in this data sheet.

2.4 Related Products

- Oerlikon Metco offers a wide variety of tungsten carbide wear-resistant coating materials for application using welding processes or thermal spray. Please contact your Oerlikon Metco Sales Representative for more information on available material choices.
- 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.

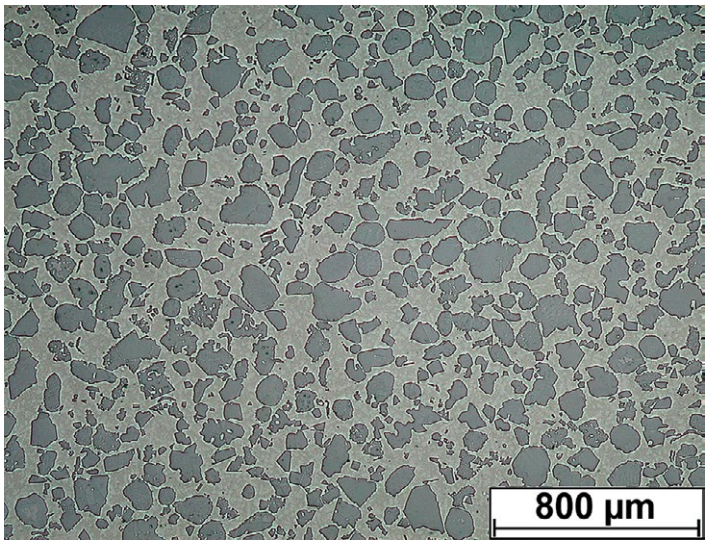
3 Coating Information

3.1 Key Overlay Characteristics

Characteristic			PlasmaDur 51122	PlasmaDur 51132	PlasmaDur 51142	PlasmaDur 51302	PlasmaDur 51322
Recommended Coating Process					Plasma Transferred Arc (PTA)		
Microhardness	MTC	HV0.1	1700 – 2000	1700 – 2000	1700 – 2000	1700 – 2000	1700 – 2000
Hardness	Matrix	HRC	48 – 54	57 – 63	37 – 44	29 – 35	28 – 34
Hardphase / Matrix Blend Ratio			60 / 40	60 / 40	60 / 40	65 / 35	60 / 40
Thickness Limit	mm in)		6 – 8 0.24 – 0.31	3 – 4 0.12 – 0.16	none	none	none

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

3.2 Typical PTA Overlay Cross Section



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 and parameter development services may be available.

4 Commercial Information

4.1 Ordering Information and Availability

Product	Order No.	Package Size	Availability	Distribution
PlasmaDur 51122	1063632 1076555	25 kg (approx. 55 lb) 10 kg (approx. 22 lb)	Stock Stock	Global Global
PlasmaDur 51132	1065367 1066233	25 kg (approx. 55 lb) 5 kg (approx. 11 lb)	Special Order Special Order	Global Global
PlasmaDur 51142	1097677 1063633	25 kg (approx. 55 lb) 10 kg (approx. 22 lb)	Stock Stock	Global Global
PlasmaDur 51302	1063636 1077007	25 kg (approx. 55 lb) 10 lb (approx. 4.5 kg)	Special Order Stock	Global Americas
PlasmaDur 51322	1063635 1076554	25 kg (approx. 55 lb) 10 kg (approx. 22 lb)	Stock Stock	Global 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 (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.
PlasmaDur 51122	50-912
PlasmaDur 51132	50-912
PlasmaDur 51142	50-911
PlasmaDur 51302	50-912
PlasmaDur 51322	50-1253

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