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Sulzer Metco

Material Product Data Sheet

8% Yttria Stabilized Zirconia Agglomerated and HOSP™ Thermal Spray Powders

Thermal Spray Powder Products: Metco 204-XCL, Metco 204B-XCL, Metco 204C-XCL, Metco 204G-XCL, Metco 204NS, Metco 204B-NS, Metco 204C-NS, Metco 204F, Metco 204NS-G, Amdry 204NS-1, Metco 204NS-AP, Metco 204AF, SPM 2000, SPM 2000-1

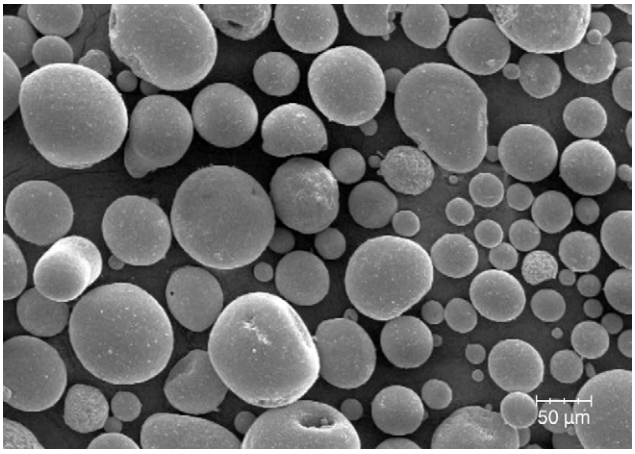
1 Introduction

Yttria stabilized zirconia ($8Y_2O_3$-ZrO_2) powders manufactured by Sulzer Metco's HOSP™ process combine the advantages of pre-alloyed, fused and crushed powders together with the free flowing, consistent shape of spray dried powders.

Densification via the Sulzer Metco HOSP™ process ensures high deposit efficiency during the coating process, reducing application time and overspray waste.

Powders are spheroidal with excellent flow, chemical homogeneity and structural stability. Compositions are manufactured from high purity raw materials, and produce coatings that provide long-lasting, reliable service.

Sulzer Metco YSZ products with our exclusive **XCL** designation are very high purity, white materials that offer extended coating life through improved sintering resistance. It is the exceptional purity of these materials, with minimized levels of low-melting trace constituents that gives coatings of **XCL** materials performance advantages in service, even at temperatures significantly above 1200 °C (2200 °F).



Photomicrograph of a typical yttria-stabilized zirconium oxide material manufactured using Sulzer Metco's HOSP™ process.

1.1 Typical Uses and Applications

Usually used as a thermal spray coating for:

- Top coat (insulating layer) in a thermal barrier coating (TBC) system for industrial and flight gas turbine engine components such as combustion liners, transition pieces, afterburners, heat shields, turbine airfoils.
- Thermal protection at temperatures up to 900 °C (1650 °F) on metallic diesel and gasoline engine components such as cylinder heads, piston crowns, exhaust and intake valves, turbochargers.
- In general, these materials are used as the insulating layer in a two-part TBC system, consisting of a thermal sprayed bond coat and YSZ top coat. For some applications, they are used as intermediate layers between an oxidation-resistant bond coat and a more porous, low-K TBC system.

Quick Facts	
Classification	Ceramic, zirconia based
Chemistry	ZrO_2 $8Y_2O_3$
Manufacture	Agglomerated & HOSP™
Morphology	Spheroidal
Apparent Density	2.3 ± 0.2 g/cm^3
Service Temperature*	
XCL Products:	≤ 1350 °C (2460 °F)
Other Products	≤ 1250 °C (2280 °F)
Melting point	2800 °C (5072 °F)
Purpose	Thermal protection
Process	Atmospheric Plasma Spray, ChamPro™ (LVPS, LPPS, VPS)

** With suitable bond coat*

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2 Material Information

2.1 Chemical Composition

Product	ZrO_2	Y_2O_3	SiO_2 (max)	TiO_2 (max)	Al_2O_3 (max)	Fe_2O_3 (max)	Monoclinic Phase (max)
Metco 204-XCL	Balance	7.0 – 8.0	0.05	0.05	0.05	0.05	10
Metco 204B-XCL	Balance	7.0 – 8.0	0.05	0.05	0.05	0.05	10
Metco 204C-XCL	Balance	7.0 – 8.0	0.05	0.05	0.05	0.05	10
Metco 204G-XCL	Balance	7.0 – 8.0	0.05	0.05	0.05	0.05	6
Metco 204NS	Balance	7.0 – 9.0	0.7	0.2	0.2	0.2	10
Metco 204B-NS	Balance	7.0 – 9.0	0.3	0.2	0.2	0.2	~ 10
Metco 204C-NS	Balance	7.0 – 9.0	0.7	0.2	0.2	0.2	~ 10
Metco 204F	Balance	7.0 – 9.0	0.7	0.2	0.2	0.2	~ 6
Metco 204NS-G	Balance	7.0 – 9.0	0.7	0.2	0.2	0.2	~ 6
Amdry 204NS-1	Balance	7.0 – 9.0	0.7	0.2	0.2	0.2	10
Metco 204NS-AP	Proprietary						
Metco 204AF	Proprietary						
SPM 2000	Proprietary						
SPM 2000-1	Proprietary						

2.2 Additional Powder Characteristics

Product		Nominal Range µm	D 90%	D 50%	D 10%
Metco 204-XCL	Metco 204NS	-125 +11	90 –109	49 – 59	20 – 28
Metco 204B-XCL	Metco 204B-NS	-75 +45	88 – 93	57 – 62	36 – 42
Metco 204C-XCL	Metco 204C-NS	-140 +45	107 –120	68 – 77	39 – 49
Metco 204G-XCL	Metco 204NS-G	-125 +11	93 –103	50 – 57	21 – 25
Metco 204F		-45 +15	36 – 45	20 – 30	10 – 20
Amdry 204NS-1		-125 +11	90 –109	49 – 59	20 – 28
Metco 204NS-AP		Proprietary			
Metco 204AF		Proprietary			
SPM 2000		Proprietary			
SPM 2000-1		Proprietary			

Particle size analysis by laser diffraction (Microtrac) in accordance with ASTM B822.

2.3 Key Selection Criteria

- Choose the product that meets the required customer material specification.
- Sulzer Metco has many products in our portfolio that can meet a wide range of customer design criteria.
- Powders products with fine particle distributions typically produce dense coating microstructures, while materials with coarser distributions produce more porous coating microstructures.
- **XCL**-designated products provide extended coating life as a result of high sintering resistance and low shrinkage. These materials can also be used in moderately higher temperature TBC applications. Coatings are the whitest in color of all TBC materials in the Sulzer Metco YSZ portfolio of products.
- Metco 204F has a very fine particle size distribution that can produce coatings with dense or dense, vertically cracked microstructures when applied using atmospheric plasma spray equipment. Metco 204F can also be applied by the combustion powder Thermospray™ process, using a Metco 6P-II spray gun at low feed rates.
- SPM-designated products are proprietary and specifically designed to produce unique coating microstructures when applied with plasma equipment at high power.
- Metco 204NS-AP is also a proprietary product that has been is tailored to produce coating having unique microstructures sprayed using very specific plasma coating conditions.
- Metco 204AF is a proprietary product designed to produce dense microstructures with smooth, as-sprayed surface textures.
- Amdry 204NS-1, Metco 204NS-G and Metco 204C-NS are slightly lower purity products. Coatings of these materials will be light cream in color, compared to coatings of other products in this datasheet, which will be white to near white.

2.4 Related Products

- Coatings of 7 – 8 % yttria stabilized zirconia exhibit better volume stability and can be used at higher service temperatures than magnesia- and calcia-stabilized materials, such as the Metco 201 family of materials and the Metco 210 family of materials.

- HOSP™ densified products exhibit higher coating deposit efficiencies than many competitive materials using alternative manufacturing technologies.

- HOSP™ densified products show better material feed characteristics than angular (fused and crushed) materials, such as Amdry 333.

- Coatings of 7 – 8 % yttria stabilized zirconia have better thermal cyclic properties compared to coatings of fully stabilized products such as Metco 202NS.

- Coatings of these materials are are somewhat more prone to chemical attack from sodium, sulfur and chlorine contaminates than ceria-stabilized materials (Metco 205NS).

- Coatings of these materials are less resistant to erosion and scuffing, and have a somewhat lower hot hardness than coatings of zirconia yttria titania (Metco 143), but can be used at higher service temperatures.

- When high coating porosities are required, agglomerated and sintered YSZ materials may be more appropriate. Metco 22xx series products are high purity agglomerated and sintered powders, equivalent to the HOSP™ XCL-designated products in this datasheet. Metco 23xx series have chemistries equivalent to today's industry standard for YSZ chemistries (see datasheet DSMTS-0047).

- Metco 6700 is a spray dried, flame-stabilized YSZ material that has a particle size distribution much finer than other Sulzer Metco yttria-zirconia based materials. It is designed to be applied using the Sulzer Metco ChamPro™ PS-PVD process, giving rise to dense coating structures, including segmented structures similar to EB-PVD.

- Sulzer Metco also offers a complete portfolio of bond coat materials, including MCrAlY materials most often used as a bond coat for these thermal barrier materials. Please see datasheets DSMTS-0092, DSMTS-0093, DSMTS-0094 and DSMTS-0102).

2.5 Customer Specifications

Product	Customer Specifications
Metco 204NS	Canada Pratt & Whitney CPW 673 Chromalloy BZ-003 Type 52 GE A50TF278, Cl B, 10042376 GE A50TF278, Cl D Hamilton Sundstrand ESR 1487 Honeywell EMS 57750, Type I, Cl 1 Honeywell M3966, Type II Honeywell M3978 Pratt & Whitney PWA 1375 Solar Turbines ES9-110B U. S. Military Kelly AFB 97P1271
Metco 204B-NS	Avio 4800M/38 GE A50TF204, Cl B Honeywell 91547-52564, Cl. B; EPS 10479 Light Helicopter LHM 3314, Type 1 Pratt & Whitney MC-2024 Rolls-Royce Corporation EMS 56722, Sec. 4.4.2.2 Rolls-Royce OMAT 3/185A Rolls-Royce plc MSRR 9507/46 Snecma DMR 33.098 Volvo PM 819-55 Williams WIMS 652
Metco 204B-XCL	Rolls-Royce plc MSRR 9507/46
Metco 204C-NS	GE A50A558 GE A50TF278, Cl A Power Systems Manufacturing LLC PSM-410-2 Appendix I Williams WIMS 770 Except 4.4.1 & 4.4.2
Metco 204NS-G	Alstom HTCT 650564 GE A50A557 GE A50TF278, Cl B, F50TF50, Cl B GE A50TF278, Cl C
AMDRY 204NS-1	Canada Pratt & Whitney CPW 673 Chromalloy BZ-003 Type 52 GE A50TF278-50, Cl B Hamilton Sundstrand ESR 1487 Honeywell EMS 57750, Type I, Cl 1 Pratt & Whitney PWA 1375 Siemens PD83336AA, Sec. 7.2 & 7.2.2 Siemens PD83336AB, MS 201 Siemens PD83336Z2, Sec. 7.3 & 7.3.2 Turbine Airfoil Coating and Repair TACR 05-366 Type 5 & 6
Metco 204NS-AP	Alstom HMHD 658042, Sec. 3.7 Alstom HMHD 658043
Metco 204AF	Pratt & Whitney PWA 36318
SPM 2000	GE A50AG1 GE A50TF278, Cl B GE A50TF278, Cl D
SPM 2000-1	GE A50AG1, Cl A

3 Coating Information

3.1 Key Thermal Spray Coating Information

Specification	Typical Data
Recommended coating processes	APS (Atmospheric Plasma Spray) or ChamPro™ (Controlled Atmosphere Plasma Spray)
Recommended bond coat	Suitable high-temperature materials that are compatible with the substrate. MCrAlY bond-coats are recommended.
Typical porosity range	8 – 20%
Thermal conductivity	0.8 – 1.3 W/mK
Thermal expansion	10 µm/m °C 5.6 µin/in °F
Specific Heat	450 ± 20 J/kgK
Post finishing	Typically used as-sprayed. May be SiC or diamond ground
Microstructure characteristics	Homogeneously porous and finely microcracked

3.2 Available Coating Parameter Sheets:

Coating parameters are available to Sulzer Metco customers. Please contact your local Sulzer Metco Account Representative. Please note that parameters may not be available for all spray gun / material combinations. For specific application requirements, Sulzer Metco Application Support Services are available.

Atmospheric PlasmaSpray Guns	
• 9MB	• SM F-100 Connex
• 11MB	• SM F-210
• F4	• Triplex*Pro*™
• i*Pro*™-90	

4 Commercial Information

4.1 Ordering Information and Availability

	Order No.	Package Size	Availability	Distribution
Metco 204-XCL	1059333	12.5 lb (approx. 5.7 kg)	Stock	Global
Metco 204B-XCL	1059332	12.5 lb (approx. 5.7 kg)	Stock	Global
Metco 204C-XCL	1058778	12.5 lb (approx. 5.7 kg)	Special Order	Global
Metco 204G-XCL	1059334	12.5 lb (approx. 5.7 kg)	Stock	Global
Metco 204NS	1000577 1000591	5 lb (approx. 2.25 kg) 12.5 lb (approx. 5.7 kg)	Stock Stock	Global Global
Metco 204B-NS	1038360	12.5 lb (approx. 5.7 kg)	Stock	Global
Metco 204C-NS	1001593	12.5 lb (approx. 5.7 kg)	Stock	Global
Metco 204F	1043121	12.5 lb (approx. 5.7 kg)	Special Order	Global
Metco 204NS-G	1000800	12.5 lb (approx. 5.7 kg)	Stock	Global
Amdry 204NS-1	1001585	12.5 lb (approx. 5.7 kg)	Stock	Global
Metco 204NS-AP*	1037601	12.5 lb (approx. 5.7 kg)	Stock	Global
Metco 204AF*	1050349	12.5 lb (approx. 5.7 kg)	Stock	Global
SPM 2000*	1019245	12.5 lb (approx. 5.7 kg)	Stock	Global
SPM 2000-1*	1029027	12.5 lb (approx. 5.7 kg)	Stock	Global

* *Available only to OEM qualified buyers*

4.2 Handling Recommendations

- Store in the original container in a dry location.
- Tumble contents gently prior to use to prevent segregation.
- Open containers should be stored in a drying oven to prevent moisture pickup.

4.3 Safety Recommendations

See MSDS 50-149 (Materials Safety Data Sheet) in the localized version applicable to the country where the material will be used. MSDS are available from the Sulzer Metco web site at www.sulzermetco.com.

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Information is subject to change without prior notice