oerlikon
metco

Material Product Data Sheet
8 % Yttria Stabilized Zirconia Agglomerated and Sintered Thermal Spray Powders

Powder Products:
Metco 231A, Metco 233A, Metco 233B, Metco 233C, Metco 234A, Metco 235A

1 Introduction

Metco™ 23xx series materials are agglomerated and sintered (AS) 8 % yttria stabilized zirconia (YsZ) powders. Most of these products have low quantities of monoclinic zirconia, but have different particle size distributions, apparent densities and chemistries. The purity of the Metco 23xx series is equal to today's industry standard for YsZ.

The consistently spheroidal particle shape of the agglomerated and sintered materials provides reliable flow and structural stability. Agglomerated and sintered powders are particularly well-suited for thermal barrier coatings (TBC) which require increased porosity.

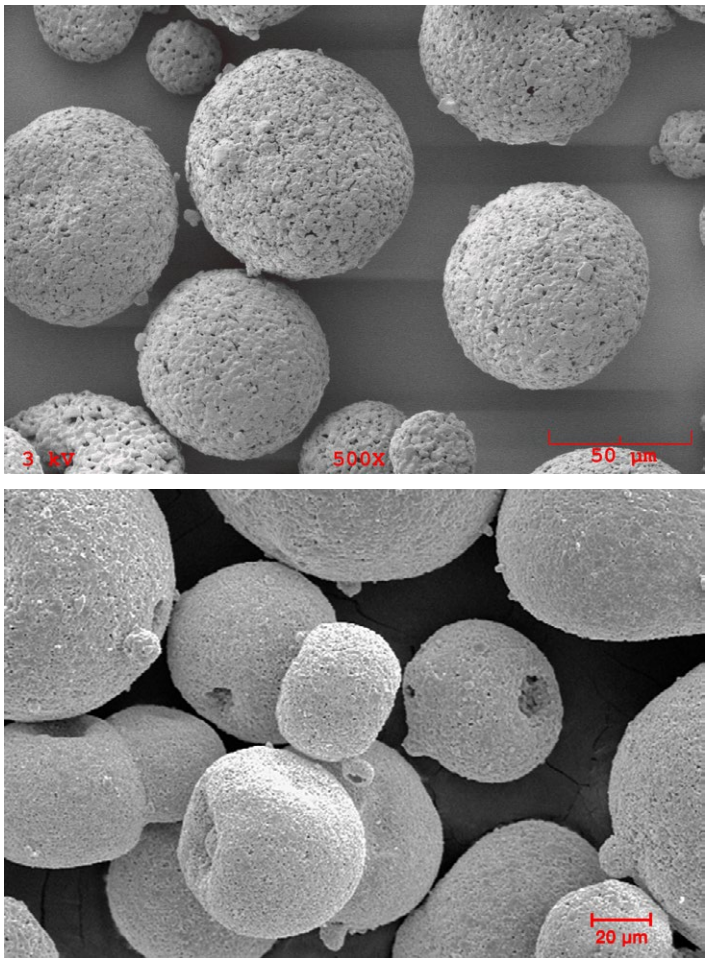
1.1 Typical Uses and Applications

Usually used as a thermal spray coating for:

- Thermal protection at temperatures up to 1250 °C (2280 °F) on metallic diesel and gasoline engine components such as cylinder heads, piston crowns, exhaust and intake valves, turbochargers.
- Thermal protective coating up to 1250 °C (2280 °F) for industrial furnace components, such as metal mesh and ceramic trays.
- Top coat (insulating layer) for thermal barrier coatings (TBCs) up to 1250 °C (2280 °F) for industrial gas turbine engine components or aero gas turbine engine components, such as combustion liners, transition pieces, afterburners, heat shields, turbine airfoils. Used in combination with an oxidation-resistant bond coat.
- Intermediate layers between an oxidation-resistant bond coat and a more porous, low-K TBC system.

Quick Facts	
Classification	Oxide ceramic, zirconia based
Chemical formula	ZrO_2 $8Y_2O_3$
Manufacture	Agglomerated and sintered
Morphology	Spheroidal
Apparent density	1.8 – 2.4 g/cm^3
Service Temperature *	≤ 1250 °C (2280 °F)
Melting point	2800 °C (5072 °F)
Purpose	Thermal protection
Process	APS, ChamPro™

* With suitable bond coat



SEM photomicrographs of typical Oerlikon Metco agglomerated and sintered yttria-stabilized zirconium oxide materials. Top: Metco 231A; Bottom: Metco 233A.

2 Material Information

2.1 Chemical and Physical Properties

Product	Chemical Composition (wt. %)							Monoclinic ZrO_2 (vol.% max)	Color
	ZrO_2 [a]	Y_2O_3	SiO_2 (max)	Al_2O_3 (max)	Fe_2O_3 (max)	TiO_2 (max)	Other Oxides (max)		
Metco 231A	Bal.	7.0 – 9.0	0.7	0.2	0.2	0.2	0.8	< 25 [b]	Cream
Metco 233A	Bal.	7.0 – 9.0	0.5	0.2	0.2	0.2	0.8	< 6	Off-White
Metco 233B	Bal.	7.0 – 9.0	0.5	0.2	0.2	0.2	0.8	< 6	Off-White
Metco 233C	Bal.	7.0 – 9.0	0.5	0.2	0.2	0.2	0.8	< 6	Off-White
Metco 234A	Bal.	7.0 – 9.0	0.5	0.2	0.2	0.2	0.8	< 6	Off-White
Metco 235A	Bal.	7.0 – 9.0	0.3	0.1	0.1	0.1	0.2	< 30	White

[a] Includes up to 2% HfO_2, counted as ZrO_2
[b] Typically, the percentage of monoclinic phase in coatings of Metco 231A is less than 5 vol. % as further stabilization occurs during the thermal spray process.

2.2 Particle Size Distribution

Product	Nominal Range (µm)	D90 (µm)	D50 (µm)	D10 (µm)
Metco 231A	-125 +45	85 – 110	50 – 70	25 – 45
Metco 233A	-125 +45	90 – 120	60 – 85	45 – 60
Metco 233B	-45 +22	38 – 49	28 – 36	20 – 27
Metco 233C	-125 +45	90 – 120	60 – 85	45 – 60
Metco 234A	-90 +15	80 – 100	40 – 60	20 – 35
Metco 235A	-65 +15	51 – 62	32 – 43	18 – 29

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.
- Metco 231A is the lowest cost agglomerated and sintered material of the series. Even though the powder has a higher monoclinic phase compared to the other powders in this series, further stabilization occurs during the thermal spray process and the resulting coatings exhibit only slightly higher monoclinic phase.
- Coatings sprayed with Metco 23xx series are cream to somewhat yellowish in color.
- Metco 233B has a fine particle size distribution that can be used to apply dense coatings.
- Metco 233C is slightly biased towards a coarser size distribution compared to Metco 233A.
- Metco 235A is specifically designed for non-turbine industrial applications such as tooling components used in furnaces for materials processing. Metco 235A produces coatings that are white in color.

2.4 Related Products

- Coatings of 8 wt.% 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 and Metco 210 series of materials.
- Coatings produced using agglomerated and sintered YsZ materials exhibit more porosity than coatings of plasma-densified materials.
- HOSP™ (spray dried / plasma densified) products, such as the Metco 204 family of materials, are spherical with excellent flow, chemical homogeneity and structural stability, with higher coating deposit efficiencies. HOSP™ products show very good material feed characteristics.
- Metco Premium-designated products are high purity HOSP products. Premium materials offer extended coating life through improved sintering and thermal shock resistance and can be used at higher service temperatures.
- Coatings with 8 wt.% yttria stabilized zirconia have better thermal cyclic properties compared to coatings of fully stabilized products such as Metco 202NS.
- Coatings of Metco 205NS (ceria-stabilized zirconia) are more resistant to chemical attack from sodium, sulfur and chlorine contaminates than coatings of yttria stabilized zirconia.
- Coatings of Metco 143 (zirconia yttria titania) have high hot hardness and are more resistant to erosion and scuffing than coatings with yttria stabilized zirconia. However, the service temperature is lower compared to YsZ coatings.
- Metco 206A (yttria-ytterbia-gadolinia-stablized zirconium oxide) has a lower thermal conductivity than 7 to 8 wt% YSZ products but coatings exhibit lower toughness. Metco 206A is used in some applications as a top coat over an agglomerated and sintered or HOSP 7 to 8 wt% YSZ ceramic.

2.5 Customer Specifications

Product	Customer Specification
Metco 233B	Allied Power Group POW-001
Metco 233C	Alstom HMHD 658157 Alstom HMHT 601770 Siemens MS 004 Index 08
Metco 234A	GE A50TF278, Cl C GKN Aerospace PM 819-57 [a] GKN Aerospace PM 819-84 GKN Aerospace MAT870011 [a]

[a] Fulfills requirements but not approved for certification

3 Coating Information

3.1 Key Thermal Spray Coating Information

Specification		Data	
Recommended Process		ChamPro™ controlled atmosphere plasma spray or atmospheric plasma spray	
Recommended Bond Coat		Compatible MCrAlY such as Amdry 962 or Amdry 995	
Max. Service Temperature		≤ 1250 °C	≤ 2280 °F
Thermal Conductivity	W/mK	0.8 – 1.3	
Thermal Expansion	µm/m/°C	10	

3.2 Coating Parameters

Please contact your Oerlikon Metco Account Representative for parameter availability. For specific coating application requirements, the services of Oerlikon Metco's Coating Solution Centers are available.

Recommended Spray Guns	
Atmospheric Plasma	**ChamPro**
Metco 3MB series	SinplexPro 03C
Metco 9MB series	
Metco F4MB-XL series	
TriplexPro series	
SinplexPro series	

4 Commercial Information

4.1 Ordering Information and Availability

Product	Order No.	Package Size	Availability	Distribution
Metco 231A	1072676	12.5 lb (approx. 5.7 kg)	Stock	Global
Metco 233A	1071597	5 kg (approx. 11 lb)	Stock	Global
Metco 233B	1083446	5 kg (approx. 11 lb)	Stock	Global
Metco 233C	1088432	5 kg (approx. 11 lb)	Stock	Global
Metco 234A	1071598	5 kg (approx. 11 lb)	Stock	Global
Metco 235A	2300867	5 kg (approx. 11 lb)	Stock	Global

4.2 Handling Recommendations

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

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.
Metco 231A	50-1552
Metco 233A	50-1552
Metco 233B	50-1552
Metco 233C	50-1552
Metco 234A	50-1552
Metco 235A	50-2891

www.oerlikon.com/metco
info.metco@oerlikon.com