

# Material Product Data Sheet

## Zirconia Gadolinia Ytterbia Yttria Agglomerated and Sintered Thermal Spray Powder

### Thermal Spray Powder Products: Metco 206A\*

#### 1 Introduction

Metco™ 206A is a zirconia-gadolinia-ytterbia-yttria based powder designed for high temperature thermal barrier applications. Key application areas are combustors, transition ducts, blades and vanes for aerospace & industrial gas engines.

The composition of Metco 206A is unique and patented by the U.S. Government, NASA (1). Its tightly controlled particle size distribution and apparent density, as well as the utilization of Oerlikon Metco's high purity raw materials results in coating microstructures with lower thermal conductivity and improved high temperature sintering resistance compared to present state-of-the-art 7% to 8% yttria-stabilized zirconia materials. Gadolinia-ytterbia-yttria dopants in the zirconium oxide promote the formation of highly-stable (oxide defect clustering) cubic-phase zirconium oxide top coats when applied using atmospheric plasma spray, resulting in a coating with reduced thermal conductivity. In addition, low levels of silica, sodium oxide and alumina have also been found to help reduce high temperature sintering at service temperatures above 1200 °C (2200 °F).

The particle size distribution of this agglomerated and sintered material has been optimized within customer specifications for enhanced flow and high porosity coating structures. Metco 206A is best applied using atmospheric plasma spray. In many cases, a thin intermediated layer of 7 – 8 wt% yttria-stabilized zirconia is recommended to improve thermal cyclic life.

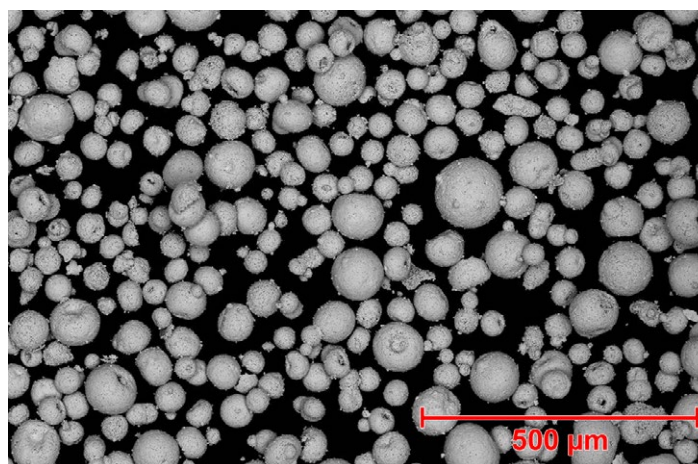
#### 1.1 Typical Uses and Applications

Typically used as a thermal barrier coating material for:

- Aerospace and industrial gas turbine applications
- Combustion liners requiring thick, porous coatings
- Blade and vane airfoils

#### Quick Facts

Classification	Oxide ceramic, zirconia-based
Chemistry	ZrO <sub>2</sub> 9.5Y <sub>2</sub> O <sub>3</sub> 5.6Yb <sub>2</sub> O <sub>3</sub> 5.2Gd <sub>2</sub> O <sub>3</sub>
Manufacture	Agglomerated and sintered
Morphology	Spheroidal
Apparent Density	2.0 ± 0.2 g/cm <sup>3</sup>
Purpose	Thermal barrier
Service Temperature	≤ 1500 °C (2370 °F)
Process	Atmospheric plasma spray



Typical SEM photomicrograph of Metco 206A, a spheroidal agglomerated and sintered zirconia-gadolinia-ytterbia-yttria thermal spray powder.

\* Restrictions on the sale and/or use of this product for commercial applications in the United States or the United Kingdom may apply. Please contact Oerlikon Metco for more information.

## 2 Material Information

### 2.1 Chemical Composition and Phase Constituents

Product	Chemical Composition (wt. %)								Monoclinic (max vol. %)
	ZrO <sub>2</sub> <sup>a</sup>	Y <sub>2</sub> O <sub>3</sub>	Yb <sub>2</sub> O <sub>3</sub>	Gd <sub>2</sub> O <sub>3</sub>	SiO <sub>2</sub> (max)	Al <sub>2</sub> O <sub>3</sub> (max)	U & Th (max)	Other Oxides (max) <sup>b</sup>	
Metco 206A	Bal.	9.0 – 10.0	5.1 – 6.1	4.7 – 5.7	0.2	0.2	0.02	0.5	6

<sup>a</sup> Including a maximum of 2.5% HfO<sub>2</sub>, counted as ZrO<sub>2</sub>

<sup>b</sup> Includes, but is not limited to TiO<sub>2</sub>, MgO, CaO and Fe<sub>2</sub>O<sub>3</sub>

### 2.2 Particle Size Distribution and Other Characteristics

Product	Nominal Particle Size Distribution (μm)	D90 (μm)	D50 (μm)	D10 (μm)
Metco 206A	-106 +22	95 – 115	50 – 70	25 – 45

Particle size analysis by laser diffraction (Microtrac) per ASTM C 1070.  
Other particle size distributions are available on request.

### 2.3 Key Selection Criteria

- Choose Metco 206A when necessary to meet customer specifications.
- Choose Metco 206A for thermal barrier coating applications operating at service temperatures between 1200 °C (2200 °F) and 1500 °C (2730 °F).
- Select Metco 206A for highly demanding thermal insulation coating requirements.
- Metco 206A is manufactured using high-purity raw materials, ensuring excellent structural stability, thermal shock and insulating properties. For more information on our XCL products, please refer to Solutions Flash 0004.
- Choose Metco 206A for thermal barrier coatings where a high porosity microstructure is desirable.
- Metco 206A is manufactured as an agglomerated and sintered material, similar to our 7% – 8% yttria-stabilized zirconia Metco 22xx and Metco 23xx families of products to create high porosity thermal barrier coatings.
- Coatings of Metco 206A have lower erosion resistance than coatings of yttria-stabilized zirconia materials and Metco 143 (YsZ TiO<sub>2</sub>) with fine particle size distributions.
- Select a product from the Metco 204 family when cost restraints or customer specifications require one of these products, or when U.S. Government restrictions on the use of Metco 206A apply.
- A product from the Metco 204 family is preferred for thinner, higher density coatings typically used at service temperatures below 1200 °C (2200 °F).
- Metco 222A or Metco 233A should be chosen for service temperature below 1200 °C (2200 °F) that require thick coatings of 0.5 to 1.0 mm (0.02 – 0.04 in) or greater.
- Chose Metco 205NS for specific environments below 1200 °C (2200 °F) where hot corrosion may be an issue.
- As Metco 206A thermal barrier coatings systems require a bond coat, choose a suitable MCrAlY bond coat material from Sulzer Metco's extensive portfolio of these products, such as Amdry 995C, Amdry 962 or Amdry 386.

### 2.4 Related Products

- Like Metco 206A, the 7% – 8% YsZ materials such as Metco 204-XCL (HOSP) and Metco 22xx families of products are manufactured using high purity raw materials that enhance structural stability, thermal shock and insulating properties. These products can also be used to create a thin, intermediate coating layer to improves thermal cyclic life with Metco 206A as a top coat.

### 2.5 Customer Specifications

Product	Customer Specification
Metco 206A	Rolls-Royce Corp. EMS 56726 * U. S. Military USAF 461206, top coating material only

\* Meets the requirements to the specification, but not approved

## 3 Coating Information

### 3.1 Key Thermal Spray Coating Information

Specification	Typical Data	
Recommended Process	Atmospheric plasma spray	
Typical Porosity	10 – 28 vol. %	
Recommended Coating Thickness	< 500 µm	< 0.020 in
Preferred Coating Thickness	300 µm	0.012 in
Thermal Conductivity As Sprayed <sup>a</sup>	0.6 – 1.0 W/m·K	
Recommended Bond Coat <sup>b</sup>	High temperature MCrAlY, such as Amdry 995C, Amdry 9951, Amdry 9624 or Amdry 997	
Intermediate Coat	7% – 8% YSZ material to improve thermal cyclic life, if necessary	
Maximum Service Temperature	1500 °C	2730 °F

Note: Coating properties will vary depending on spray hardware and spray parameters used.

<sup>a</sup> Thermal conductivity will increase with time and application temperature

<sup>b</sup> May be applied using atmospheric plasma spray, HVOF or controlled atmosphere plasma spray, as desired or necessary to meet customer requirements.

### 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 Atmospheric Plasma Spray Guns

Metco 9MB series

Metco F4 series

TriplexPro series

SimplexPro series

## 4 Commercial Information

### 4.1 Ordering Information and Availability

Product	Order No.	Package Size	Availability	Distribution
Metco 206A	1075115	5 kg (approx. 11 lb)	Stock	Global

### 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 the SDS 50-1448 (Safety Data Sheet) in the localized version applicable to 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).

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Information is subject to change without prior notice.