

Material Product Data Sheet

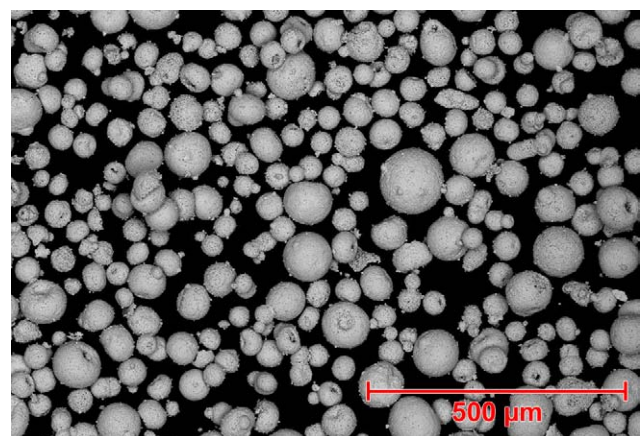
Zirconia Gadolinia Ytterbia Yttria Agglomerated and Sintered Thermal Spray Powder

Thermal Spray Powder Products: Metco™ 206A ⁽¹⁾

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 Sulzer Metco's XCL 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).



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

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 intermediate 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 ₂ 9.5Y ₂ O ₃ 5.6Yb ₂ O ₃ 5.2Gd ₂ O ₃
Manufacture	Agglomerated and sintered
Morphology	Spheroidal
Apparent Density	2.0 ± 0.2 g/cm ³
Purpose	Thermal barrier
Service Temperature	≤ 1500 °C (2730 °F)
Process	Atmospheric plasma spray

1) This product is qualified for United States Government programs and is offered only to companies operating under a United States Government contract that provides United States Government licensing authority or other qualified immunity.

2 Material Information

2.1 Chemical Composition and Phase Constituents

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

* Including a maximum of 2.5% HfO₂, counted as ZrO₂

** Includes, but is not limited to TiO₂, MgO, CaO and Fe₂O₃

2.2 Particle Size Distribution

Product	Nominal Range	D90	D50	D10
Metco 206A	-125 +45 µm	95 – 115 µm	50 – 70 µm	25 – 45 µm

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.

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 improve thermal cyclic life with Metco 206A as a top coat.
- 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 mate-

2.4 Related Products (continued)

rials and Metco 143 (YsZ TiO₂) with fine particle size distributions.

- Select a product from the Metco 204 family when cost restraints or customer specification require one of these products, or for non-U.S. Government applications where Metco 206A cannot be used.
- 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.

2.5 Customer Specifications

Product	Specification
Metco 206A	Rolls-Royce Corp. EMS 56726

3 Coating Information

3.1 Key Thermal Spray Coating Information

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

Specification	Typical Data
Recommended Spray Process	Atmospheric Plasma Spray
Typical Porosity	10 – 25 vol. %
Recommended Coating Thickness	< 500 µm < 0.020 in
Preferred Coating Thickness	300 µm 0.012 in
Thermal Conductivity (as sprayed) ⁽¹⁾	0.6 – 1.0 W/m·K
Recommended Bond Coat ⁽²⁾	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

¹ Thermal conductivity will increase with time and application temperature

² May be applied using atmospheric plasma spray, HVOF or controlled atmosphere plasma spray, as desired or necessary to meet customer requirements.

3.2 Available Coating Parameter Sheets:

Coating parameters are available to Sulzer Metco customers. Please contact your local Sulzer Metco Account Representative. For specific application requirements, Sulzer Metco Application Support Services are available.

Plasma Guns:

- F4MB-XL
- 9MB
- TriplexPro series guns

4 Commercial Information

4.1 Ordering Information and Availability

Product	Order No.	Package Size	Availability	Distribution
Metco 206A	1075115	5 kg (approx. 11 lb)	Special Order	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 MSDS 50-1448 (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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