

Material Product Data Sheet

Zirconium Oxide Ceramic Abradable Powders

**Thermal Spray Powder Products:
Durabrade™ 2192, Metco™ 213, Metco 2395,
Metco 2460NS**

1 Introduction

Oerlikon Metco's zirconia-based polyester ceramic thermal spray powders produce high temperature abradable coatings for clearance control applications in the turbine section of aerospace and industrial gas turbine engines.

Clearance control coatings are used in applications where rotating components may come into contact with the coating as a result of design intent or operational surges. The coatings are designed to minimize the wear to the rotating components while maximizing gas path efficiency by providing clearance control in seal areas.

Coatings of these abradables combine good thermal stability at high temperature, good thermal shock resistance, adequate erosion resistance and good abradability.

To meet these requirements, the zirconia matrix of these coating materials is stabilized with either yttria or dysprosium oxide to improve high temperature thermal cycle life. Polymer is added into the spray powder to impart porosity into the coatings when plasma sprayed with beneficial characteristics that:

- Reduce thermal conductivity
- Improve sintering resistance
- Improve abradability when cut by untipped, cubic boron nitride or silicon carbide tipped blades.

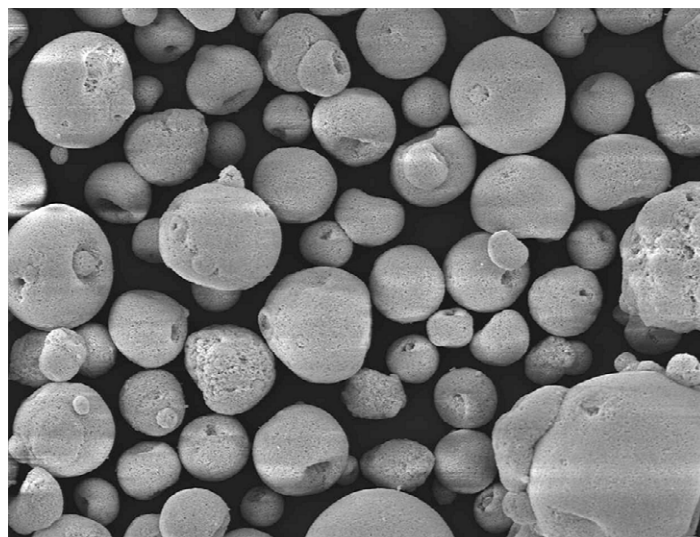
Dysprosia-stabilized zirconia abradable coating materials have been designed with a high purity ceramic matrix that improves the high temperature performance of the coating.

1.1 Typical Uses and Applications

- Typically, coatings of these materials are used in industrial and aerospace gas turbine engines.
- High pressure turbine seal applications at service temperatures up to 1150 °C (2100 °F)
- Abradable coatings that can be run against untipped, cBN or SiC tipped blades, depending on the application.
- Combustion liners requiring thick, porous coatings for thermal protection and insulation.

Quick Facts

Classification	Abradable, zirconia-based
Chemistry	Yttria/Zirconia/Polyester or Dysprosia/Zirconia [/Polyester]
Manufacture	Agglomerated or blended
Morphology	Spheroidal
Purpose	Clearance control coatings
Service Temperature	≤ 1150 °C (2100 °F)
Process	Atmospheric Plasma Spray



Typical SEM of a ceramic abradable powder, SM 2460NS. This agglomerated spherical powder consists of yttria-zirconia and a polymer.

2 Material Information

2.1 Chemical Composition

Product	Weight Percent (nominal)							
	ZrO ₂ *	Dy ₂ O ₃	Y ₂ O ₃	Polymer	Binder	hBN	Impurities (max)	Color
Durabrade 2192	Balance	9.5	---	4.5	---	0.7	1.0	off-white
Metco 213	Balance	8 – 12	---	---	---	---	1.0	off-white
Metco 2395	Balance	---	7.5	4.5	---	0.7	0.2	off-white
Metco 2460NS	Balance	---	7.5	4	4	---	0.9	off-white

* maximum of 2.5 wt% hafnia

2.2 Particle Size Distribution and Manufacturing Method

Product	Nominal Range (µm)	Average (µm)	Manufacturing Method
Durabrade 2192	-176 +11	65	Agglomerated, HOSP & Blended
Metco 213	-125 +11	52	Agglomerated, HOSP
Metco 2395	-176 +11	57	Agglomerated, HOSP & Blended
Metco 2460NS	-176 +11	74	Agglomerated

Particle size analysis using laser diffraction (Microtrac)

2.3 Key Selection Criteria

- Coatings of these materials can be applied with high porosity levels, with coatings of Durabrade 2192 and Metco 2395 sprayable to higher levels than Metco 2460NS. Higher porosity levels improve thermal shock life, reduce erosion resistance and improve abrasability. These characteristics should be carefully balanced to suit the specific application.
- Coatings of any of these ceramic abrasable materials are readily cut by cBN tipped blades.
- Under certain design conditions, seal coatings of Durabrade 2192 and Metco 2395 can be cut by bare, untipped blades.
- Metco 2460NS coatings offer the best erosion resistance.
- For a given porosity level, Durabrade 2192 coatings have the best thermocycling resistance and the lowest thermal conductivity.
- Durabrade 2192 and Metco 213 employ a high-purity ceramic that results in coatings with improved sintering resistance and extended coating life.

- Metco 213, with no fugitive phase, can be sprayed with a dense, advanced coating structure with improved erosion properties. It can also be sprayed at a higher deposit efficiency.
- Metco 213 can also be used as a thermal barrier material.
- Always choose the material that meets the customer material and process specifications.

2.4 Related Products

- No other abrasable coating products are currently available for service temperatures up to 1150 °C (2100 °F).
- Oerlikon Metco offers a wide-range of abrasable seal material products for service temperatures up to 750 °C (1380 °F). Please contact your Oerlikon Metco Account Representative for additional information.
- Oerlikon Metco offers a wide range of MCrAlY materials appropriate for use as bond coats for these products. Please ask your Oerlikon Metco Sales Representative for more information.

2.5 Customer Specifications

Product	Customer Specification
Metco 2395	GE A50AG2 ^a
Metco 2460NS	IHI Corp. ISAJT-M915 MTU MTS 1471

^a Meets requirements but not able to be certified

3 Coating Information

3.1 Key Thermal Spray Coating Information

Specification	Durabrade 2192	Metco 213	Metco 2395	Metco 2460NS
Recommended Process	Atmospheric Plasma Spray (all products)			
Bond Coat	High temperature MCrAlY bond coat (all products)			
Recommended Bond Coat Materials ^a	Amdry 962, Amdry 995C (all products)			
Porosity	25 – 35 %	< 5 %	25 – 40 %	15 – 30 %
Hardness ^b	70 – 90 HR15Y	77 – 86 HR15Y	70 – 90 HR15Y	80 – 95 HR15Y
Coating Strength ^c	> 3 MPa (435 psi)	> 10.3 MPa (1500 psi)	> 3 MPa (435 psi)	> 4 MPa (580 psi)

^a Many customer coating specifications specify proprietary MCrAlY bond coat materials available to authorized users. Please check with your Oerlikon Metco Account Representative for availability.

^b In accordance with ASTM E18

^c In accordance with ASTM C633

3.2 Post-Coating Polyester Removal

If it is necessary to perform a post-coating burnout of the polymer, the recommended heat treatment cycle is as follows:

- **Atmosphere:** Air with proper exhaust
- **Ramp up:** Room temperature to 450 °C (842 °F) at 5 to 8 °C/min (9 to 14.5 °F/min)
- **Heat soak:** 450 °C (840 °F) for 8 hours
- **Ramp down:** Turn furnace off and allow parts to cool for at least 2 hours before removing. To reduce cooling time, the furnace door can be opened after the first 1/2 hour.

The heat treatment cycle may vary based on part geometry, coating thickness and part size.

3.3 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	SinplexPro Series
Metco F4 series	8MB
TriplexPro-210	iPro-90

4 Commercial Information

4.1 Ordering Information and Availability

	Order No.	Package Size	Availability	Distribution
Durabrade 2192	1064552	5 lb (approx. 2.25 kg)	Stock	Global
Metco 213	1098409	12.5 lb (approx. 5.7 kg)	Special Order	Global
Metco 2395	1064799	5 lb (approx. 2.25 kg)	Stock	Global
Metco 2460NS	1002385	5 lb (approx. 2.25 kg)	Stock	Global

4.2 Handling Recommendations

- Store in the original container in a dry location.
- Tumble contents prior to use to prevent segregation.
- Open containers should be stored in a drying oven at temperatures below 38 °C (100 °F) to prevent moisture pickup.

4.3 Safety Recommendations

See the correct SDS (Safety Data Sheet) for the product of interest 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.
Durabrade 2192	50-1243
Metco 213	50-848
Metco 2395	50-843
Metco 2460NS	50-527