

Material Product Data Sheet

Ytterbia Zirconate Based Ceramic Abradable Powders

Thermal Spray Powder Products: Durabrade 2197, Durabrade 2198, Durabrade 2198A^a

1 Introduction

Durabrade™ 2197, Durabrade 2198 and Durabrade 2198A are ytterbia-zirconate-based ceramic thermal spray powders designed to produce high temperature abradable coatings for clearance control applications in the turbine section of industrial gas turbines. The products are manufactured exclusively for Siemens AG Power Generation Group.

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 abrasives combine good thermal stability at high temperature, good thermal shock resistance, adequate erosion resistance and good abrasibility.

These ytterbia zirconate abradable coating materials have been designed with a very pure ceramic matrix that improves the high temperature performance of the coating.

The polymer component in Durabrade 2198 is added to impart porosity into the coatings when plasma sprayed with beneficial characteristics that:

- Reduce thermal conductivity
- Improve sintering resistance
- Improve abrasibility when cut by untipped or cubic boron nitride blades

1.1 Typical Uses and Applications

Typically, coatings of these materials are used in industrial gas turbine engines for:

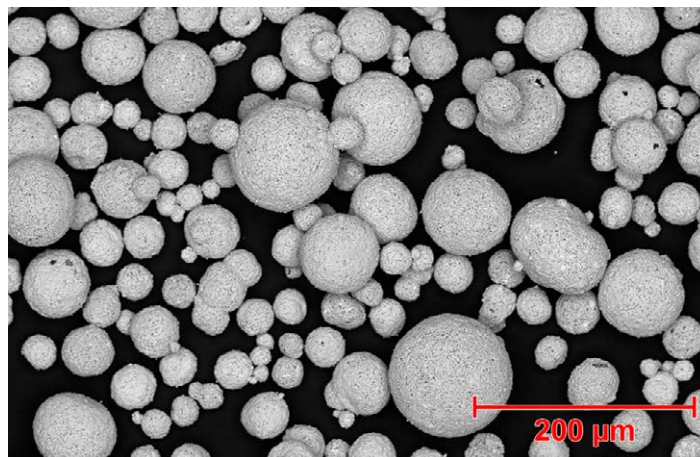
- High pressure turbine seal applications at service temperatures up to 1150 °C (2100 °F)
- Abradable coatings that can be run against untipped or cBN tipped blades, depending on the application.

^a These products are only sold to Siemens or Siemens authorized users.

Quick Facts

| | |
|----------------------------------|-------------------------------------|
| Classification | Abradable, ytterbia zirconate based |
| Chemistry | Proprietary |
| Manufacture | Agglomerated & sintered or blended |
| Morphology | Spheroidal |
| Purpose | Clearance Control |
| Service Temperature ^b | ≤ 1150 °C (2100 °F) |
| Process | Atmospheric plasma spray |

^b Long term service temperatures of at least 1250 °C (2280 °F) have been demonstrated by Siemens.



SEM photomicrographs of Durabrade 2197, showing the morphology that is typical for this product.

2 Material Information

2.1 Chemical Composition

| Product | Chemistry |
|-----------------|--|
| Durabrade 2197 | Proprietary Ytterbia Zirconate Oxide Ceramic |
| Durabrade 2198 | Proprietary Ytterbia Zirconate Oxide Ceramic + Polyester |
| Durabrade 2198A | Proprietary Ytterbia Zirconate Oxide Ceramic + Polyester |

2.2 Particle Size Distribution, Manufacturing Method, Color

| Product | Nominal Particle Size Distribution (µm) | Average Particle Size (µm) | Manufacturing Method | Color |
|-----------------|---|----------------------------|-----------------------------------|-----------|
| Durabrade 2197 | -176 +11 | 61 | Agglomerated & Sintered | Off White |
| Durabrade 2198 | -176 +11 | 64 | Agglomerated & Sintered / Blended | Off White |
| Durabrade 2198A | -176 +11 | 64 | Agglomerated & Sintered / Blended | Off White |

Particle size analysis using laser diffraction (Microtrac)

2.3 Key Selection Criteria

- Coatings of these materials can be applied with high porosity levels. 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 these ceramic abrasable materials are readily cut by cBN tipped blades.
- Under certain design conditions, seal coatings of Durabrade 2198 or Durabrade 2198A can be cut by bare, untipped blades.
- Both Durabrade 2197 and Durabrade 2198 series employ a high-purity ceramic that result in coatings with improved sintering resistance and extended coating life.

2.4 Related Products

- Oerlikon Metco offers the following yttria-stabilized zirconia ceramic abrasable products for service temperatures up to 1150 °C (2100 °F):
 - Durabrade 2192
 - Metco 2395
 - Metco 2460NS
- Please review Product Data Sheet DSMTS-0014 or contact your Oerlikon Metco Account Representative for additional information.

2.5 Customer Specifications

| Product | Customer Specifications |
|-----------------|--|
| Durabrade 2197 | Siemens Energy DGTLV 511143001 Index A Siemens Energy PD83336Y5 |
| Durabrade 2198 | Siemens Energy PD83336X1 |
| Durabrade 2198A | Siemens Energy PD83336X1 |

3 Coating Information

3.1 Post-Coating Polyester Removal

For coatings of Durabrade 2198 or Durabrade 2198A, it is necessary to perform a post-coating burnout of the polymer. The recommended heat treatment cycle is as follows:

| Process Step | Recommendation |
|--------------|--|
| Furnace Type | Atmospheric (air) with proper exhaust |
| Ramp Up | Room temperature to 450 °C (842 °F) at 5 – 8 °C/min (9 – 14.5 °F/min) |
| Heat Soak | 450 °C (840 °F) for 8 h |
| Ramp Down | Turn furnace off. Allow parts to cool for at least 2 h before removing. To reduce cooling time, the furnace door can be opened after the first 0.5 h. The heat treatment cycle may vary based on part geometry, coating thickness and part size. |

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 |
|-----------------|-----------|--------------------------|---------------|--------------|
| Durabrade 2197 | 1077087 | 12.5 lb (approx. 5.7 kg) | Stock | Global |
| Durabrade 2198 | 1077088 | 12.5 lb (approx. 5.7 kg) | Special Order | Global |
| Durabrade 2198A | 1090946 | 12.5 lb (approx. 5.7 kg) | Special Order | Global |

Note: These products are only sold to Siemens or Siemens authorized users.

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 SDS (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 (Resources – Safety Data Sheets).

| Product | SDS No. |
|-----------------|---------|
| Durabrade 2197 | 50-1384 |
| Durabrade 2198 | 50-1385 |
| Durabrade 2198A | 50-1385 |

Information is subject to change without prior notice.