

Material Product Data Sheet

Nickel Chromium Aluminum / Bentonite Abradable Powders

Thermal Spray Powder Products: Durabrade 2313, Metco 314NS, Metco 312NS, Durabrade 2311

1 Introduction

Oerlikon Metco's nickel chromium aluminum bentonite thermal spray powders were developed to produce abradable coatings for clearance control applications in the compressor section of jet 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.

The products herein are cermet powders consisting of a nickel chromium aluminum alloy fully encapsulating the stabilized bentonite core. Encapsulation is achieved using a chemical cladding process. This provides a robust, high quality, binder-free composite powder with no tendency for segregation during transport, storage or spraying.

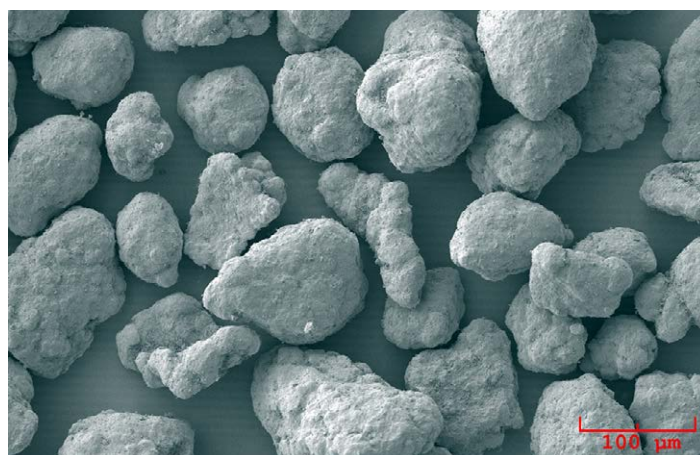
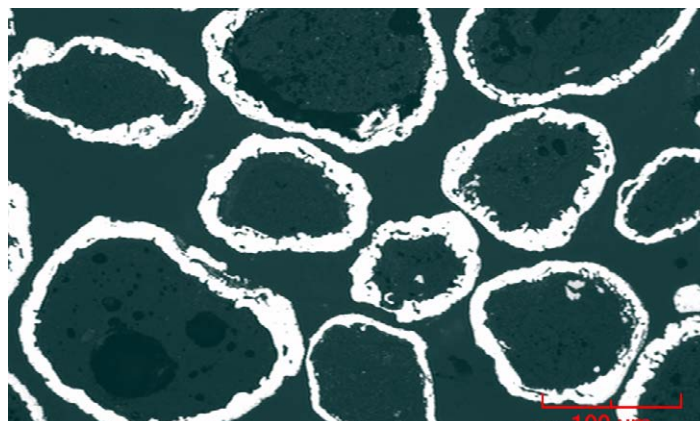
The powders were designed to produce coatings with varied erosion resistance and abradability, as desired by the customer to suit the end application. Coatings are designed to rub against nickel-based alloys or steel hardware. Extensive testing of NiCrAl / Bentonite coatings for over 8000 hours at 650 °C (1200 °F) demonstrated good oxidation resistance.

1.1 Typical Uses and Applications

- Coatings of NiCrAl / Bentonite have successfully been used in the high-temperature, high-pressure section of jet engine compressors for decades and have accumulated millions of flight hours. Oerlikon Metco NiCrAl / Bentonite is the reference compressor abradable material for applications in the temperature regime above 500 °C (930 °F).
- Abradable coatings for:
 - Gas turbine high pressure compressor stages (nickel-based alloy or steel blades)
 - Steam turbine labyrinth seals
- Thermal barrier filler for honeycomb seals

Quick Facts

Classification	Abradable, nickel-based
Chemistry	Ni 4Cr 4Al 21Bentonite
Manufacture	Chemically clad
Morphology	Rounded
Purpose	Clearance control (nickel and steel components), thermal barrier insulation
Apparent Density	2.3 ± 0.3 g/cm ³
Service Temperature	≤ 650 °C (1200 °F)
Process	Combustion Powder Thermospray™



Photomicrographs: Cross-section (top), SEM morphology (bottom).

2 Material Information

2.1 Chemical Composition

	Weight Percent (nominal)			
	Nickel	Chromium	Aluminum	Bentonite
Durabrade 2313*	Balance	4	4	21
Metco 314NS*	Balance	4	4	21
Metco 312NS	Balance	4	4	21
Durabrade 2311	Balance	4	4	21

* Equivalent products. Please review Section 2.3, Key Selection Criteria.

2.2 Particle Size Distribution

	Nominal Range (μm) ^a	D50 (μm) ^b
Durabrade 2313	-177 +74	120 – 135
Metco 314NS	-177 +74	120 – 135
Metco 312NS	-150 +45	90 – 105
Durabrade 2311	-149 +45	90 – 105

^a Sieve analysis in accordance with ASTM B214

^b Particle size analysis using laser diffraction (Microtrac)

2.3 Key Selection Criteria

- The choice of a particular grade of NiCrAl/Bentonite will depend on the desired properties of the coating. Harder more erosion resistant coatings will be sprayed with the finer cuts of the powder (-149 μm); softer, less erosion resistant, but more abradable coatings will be sprayed using the coarser powder cut (-177 μm).
- Durabrade 2313 is recommended for new applications. Metco 314NS is recommended for existing repair applications.
- Metco 312NS and Durabrade 2311 have proven track records in jet engines for military applications. Durabrade 2313 and Metco 314NS are preferred for abradable coatings in civil jet engines.
- Always choose the material that meets the customer material and process specifications.

2.4 Related Products

- Coatings of NiCrAl/Bentonite have higher temperature capability than coatings of AlSi-Polyester, AlSi-BN, AlSi/Polyimide, AlSi-Graphite or Ni/Graphite materials.
- When higher temperature capability than 650 °C (1200 °F) is required, Metco 2043 or Metco 301NS should be considered.
- Coatings exhibit improved erosion resistance and temperature capability over Ni/Graphite materials.
- NiCrAl/Bentonite coatings are not recommended to rub against untipped titanium alloy blades. Against untipped, bare titanium alloy blades, the use of Metco 2042 (CoNiCrAlY-based) is recommended in the temperature range of 450 – 550 °C (840 – 1020 °F).

2.5 Customer Specifications

Product	Customer Specification
Durabrade 2313	MTU MTS 1412 Rolls-Royce plc MSRR 9507/54
Metco 314NS	Pratt & Whitney PMC 5129-1 Rolls-Royce Corporation EMS 56771 Rolls-Royce OMAT 3/202\ Rolls-Royce plc MSRR 9507/54 Rolls-Royce plc RRMS 40014 Rolls Royce plc Comat 03-328
Metco 312NS	GE B50TF232, CI A GKN Aerospace PM 819-54 Honeywell EMS 57761 Honeywell FP 5045, Type XXV MTU MTS 1237 Pratt & Whitney PWA 1393 Rolls-Royce plc MSRR 9507/45
Durabrade 2311	GE B50TF232, CI A GKN Aerospace PM 819-54 Honeywell FP 5045, Type XXV Pratt & Whitney PWA 1393 Rolls-Royce plc MSRR 9507/45

3 Coating Information

3.1 Key Thermal Spray Coating Information

Specification	Data (all materials)		
Required Spray Process	Combustion Powder Thermospray™		
Recommended Process Fuel Gas	Acetylene		
Color As Sprayed	Gray		
Surface Roughness (Ra)	As Sprayed Machined	30 – 53 µm 17 – 29 µm	1200 – 2100 µin 650 – 1100 µin
Macrohardness (HR15Y)	30 – 60		
Coating Density (g/cm ³)	2.4 – 3.2		
Coating Weight	0.24 – 0.32 kg/m ² /0.1 mm	0.013 – 0.017 lb/ft ² /0.001 in	
Thickness Limitation	none		
Maximum Service Temperature (long term use)	650 °C/1200 °F		
Substrate Preheat Temperature	90 – 120 °C	190 – 250 °F	
Substrate Temperature During Spraying (approx.)	175 °C/350 °F		
Typical Application Rate Per Pass	0.15 mm	0.006 in	
Post Finishing Technique	Machine (tungsten carbide tooling), avoid grinding		

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 Combustion Powder Spray Guns

Metco 6P-II series

Metco 6P-II with 6PT Extension Module

4 Commercial Information

4.1 Ordering Information and Availability

	Order No.	Package Size	Availability	Distribution
Durabrade 2313	1043564	5 kg (approx. 11 lb)	Stock	Global
Metco 314NS	1000592	12.5 lb (approx. 5.7 kg)	Stock	Global
Metco 312NS	1000447	12.5 lb (approx. 5.7 kg)	Stock	Global
Durabrade 2311	1043555	10 lb (approx. 4.5 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 2313	50-1057
Metco 314NS	50-158
Metco 312NS	50-158
Durabrade 2311	50-1057