oerlikon
metco

Material Product Data Sheet
Nickel Chromium Aluminum / Bentonite Abradable Powders

Powder Products:
Metco 314NS, Metco 312NS

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.

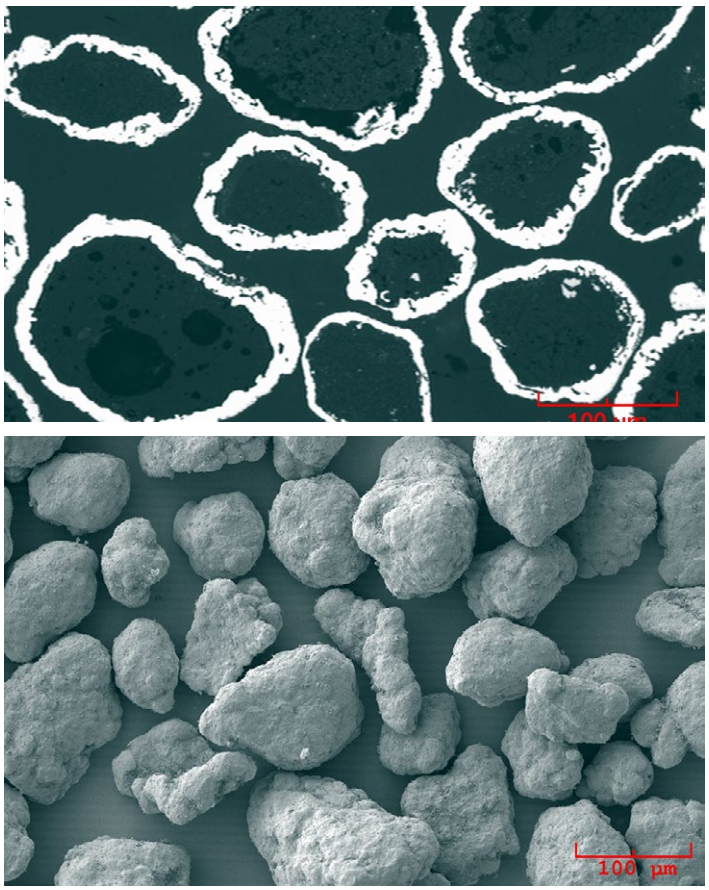
The products herein are cermet powders consisting of a nickel chromium aluminum alloy fully encapsulating the stabilized bentonite core. Encapsulation is achieved using a chemical cladding process. This provides a robust, high quality, binder-free composite powder with no tendency for segregation during 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**
Metco 314NS*	Balance	4	4	21
Metco 312NS	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]
Metco 314NS	–177 +74	120 – 135
Metco 312NS	–150 +45	90 – 105

[a] Sieve analysis in accordance with AS™ 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).
- Metco 314NS is recommended for existing repair applications.
- Metco 312NS has a proven track records in jet engines for military applications. Metco 314NS is 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
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, Cl 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

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 °C1200 °F	
Substrate Preheat Temperature		90 – 120 °C	190 – 250 °F
Substrate Temperature During Spraying (approx.)		175 °C350 °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
Metco 314NS	1000592	12.5 lb (approx. 5.7 kg)	Stock	Global
Metco 312NS	1000447	12.5 lb (approx. 5.7 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.
Metco 314NS	50-158
Metco 312NS	50-158

www.oerlikon.com/metco
info.metco@oerlikon.com