

Material Product Data Sheet

80 % Nickel / 20 % Aluminum Chemically Clad Powders

Thermal Spray Powder Products: Metco 404NS, Metco 2101ZB

1 Introduction

Metco™ 404NS and Metco 2101ZB are fine, spheroidal powders comprised of an aluminum core encapsulated in a nickel shell

Manufactured using the hydrometallurgy process, the chemically clad composite particles in these materials demonstrate consistent chemistry and nickel shell thickness surrounding the aluminum core.

Accepted in the aerospace industry for many decades, these materials show very good oxidation resistance and excellent thermal shock resistance in turbine applications.

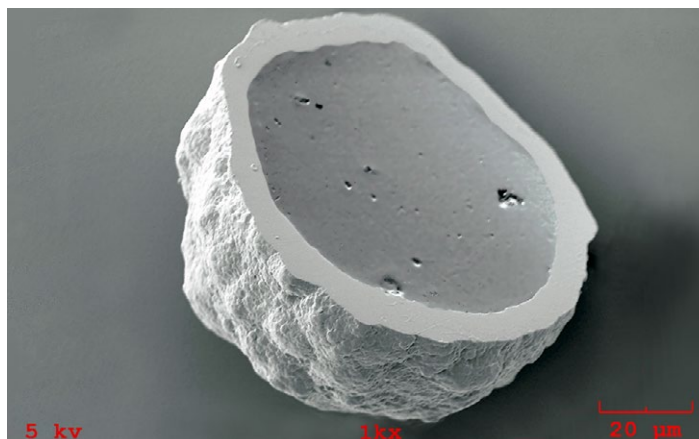
A key characteristic of these powders is that they form coatings that are self-bonding to a wide variety of metallic substrates. Self-bonding materials require a minimum of surface preparation for good coating adherence, which is useful on thin or hard substrates that cannot be effectively grit blasted. During the spray process, the nickel and aluminum chemically unite to form nickel-aluminides in an exothermic reaction that impart additional heat to the molten particles. This intermetallic compound exhibits superior properties at elevated temperatures.

1.1 Typical Uses and Applications

- As a bond coat to improve the adherence of a subsequently sprayed top coat deposit
- As an intermediate coating to mitigate mismatch of materials with different thermal expansion coefficients
- As an oxidation resistant bond coat for service temperatures up to 650 °C (1200 °F)
- Dense, abrasion resistant and oxidation resistant coatings for salvage and buildup applications on machinable carbon and corrosion-resistant substrates
- Metco 2101ZB is also used as an abradable honeycomb filler materials. Refer to Datasheet DSMB-0051.

Quick Facts

Classification	Nickel-based
Chemistry	Ni/Al
Manufacture	Chemically clad
Morphology	Rounded
Apparent density	2.5 – 3.5 g/cm ³ (minimum)
Service temperature	≤ 650 °C (1200 °F)
Purpose	Bond coatings, salvage and restoration coatings
Process	Combustion Powder Thermospray™ or Atmospheric Plasma Spray



Cross-sectional photomicrograph of Metco 404NS powder particle

2 Material Information

2.1 Chemical Composition, Particle Size Distribution and Apparent Density (nominal values)

Product	Weight Percent		Particle Size Distribution μm	Apparent Density
	Ni	Al	μm	g/cm^3
Metco 404NS	80	20	-90 +53	3.0
Metco 2101ZB	80	20	-125 +45	3.2

Particle size analysis using sieve in accordance with ASTM B214.

2.2 Key Selection Criteria

- Metco 2101ZB has a coarser particle size distribution and will produce coatings with greater surface roughness than Metco 404NS.
- While all of these powders can be sprayed using either the atmospheric plasma or combustion powder spray processes, improved oxidation resistance and higher density is achieved using atmospheric plasma spray.
- Diamalloy 4008NS, designed for the HVOF spray process, has the finest particle size distribution of all Metco Ni/Al powders, producing a finer as-sprayed surface finish.
- For improved oxidation resistance and higher temperature capability, coatings of Metco 43C-NS, Metco 43F-NS, Metco 43VF-NS, Amdry 4532, Amdry 4535 or Metco 5640NS can be considered; however, coatings of these nickel-chromium materials are not self-bonding.

2.3 Related Products

- Other Metco Ni/Al bond coat powders include mechanically clad composites such as Metco 450NS, Metco 450P and Amdry 956, as well as pre-alloyed materials such as Metco 480NS and Diamalloy 4008NS, all of which contain 4.5% to 5% aluminum. The reduced aluminum content decreases the aluminide-forming exothermic reaction during the spray process, but increases the service temperature.
- For high oxidation resistance and resistance to hot corrosive gases, coatings of Amdry 960 and Metco 443NS can be considered, which are aluminum clad nickel-chromium materials. These materials are self-bonding when atmospheric plasma sprayed, but not if sprayed using the combustion powder spray process.

2.4 Customer Specifications

Product	Customer Specification
Metco 404NS	CFM International CP 6005 Chromalloy BZ-003, Type 2 Chromalloy C-72 Chromalloy RCC No. 1 GE B50TF33, CI A GE P6-TE957 GKN Aerospace PM 819-21 Honeywell EMS 57746, Type II, CI 2 Honeywell FP 5045, Type II Honeywell M3952 MTU MTS 1073 Pratt & Whitney PWA 1321 Rolls-Royce plc MSRR 9507/4 Snecma DMR 33.010 U. S. Military USAF 67A60753, Type P-3
Metco 2101ZB	GE B50TF13, CI A and B

3 Coating Information

3.1 Key Thermal Spray Coating Information

Specification	Typical Data	
Recommended Process	Atmospheric plasma spray or combustion powder Thermospray™	
Deposit Efficiency	50 – 65 %	
Density	approx.	6.9 g/cm ³
Weight	approx.	0.69 kg/m ² /0.1 mm 0.036 lb/ft ² /0.001 in
Coefficient of Thermal Expansion	12.6 x 10 ⁻⁶ /K (27 to 538°C) 7 x 10 ⁻⁶ /°R (80 to 1000 °F)	
Electrical Resistivity	220 μΩ/cm	
Macrohardness	HRB	75 – 81
Microhardness	HV0.3	190 – 230
	HK50	320 – 685
Bond Strength	20.7 MPa	3000 psi
Post Finishing	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 Spray Guns

Atmospheric Plasma	Combustion Powder
Metco 3MB series	Metco 5P-II
Metco 9MB series	Metco 6P-II series
Metco F4 series	
SimplexPro series	
TriplexPro series	

4 Commercial Information

4.1 Ordering Information and Availability

Product	Order No.	Package Size	Availability	Distribution
Metco 404NS	1000060	5 lb (approx. 2.25 kg)	Stock	Global
Metco 2101ZB	1043511	10 lb (approx. 4.5 kg)	Special Order	Global

4.2 Handling Recommendations

- Store in the original, closed container in a dry location.
- Carefully tumble contents prior to use to prevent segregation.
- Open containers should be stored in a drying oven at low temperatures 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 404NS	50-161
Metco 2101ZB	50-999

Information is subject to change without prior notice.