oerlikon
metco

Material Product Data Sheet
Nickel – Aluminum Materials

Powder Products:
Amdry™ 956, Metco™ 404NS, Metco 450NS, Metco 447NS, Metco 480NS, Metco 2101ZB, Diamalloy™ 4008NS

Wire Products:
Metco 405A, Metco 8400, Metco 8405, Metco 8447

1 Introduction

Oerlikon Metco's portfolio of nickel-aluminum materials are used as general purpose coating materials for restoration of worn or mismachined components. They are also widely used as bond coats for OEM-specified and general industrial applications under top coats such as ceramics and compressor abradables. Nickel-aluminum coatings can have good oxidation resistance up to 800 °C (1470 °F), depending on the application environment.

The product range can be divided into:

Exothermic materials:
These powders and wires exhibit an exothermic reaction during spray processing, and are considered 'self-bonding' to metal alloy substrates — typically steel alloys. The exothermic reaction is enabled by the presence of an aluminum or aluminum-based mechanical or chemical cladding on nickel powder core for powder products or an aluminum sheath filled with a nickel powder or solid core for wires.

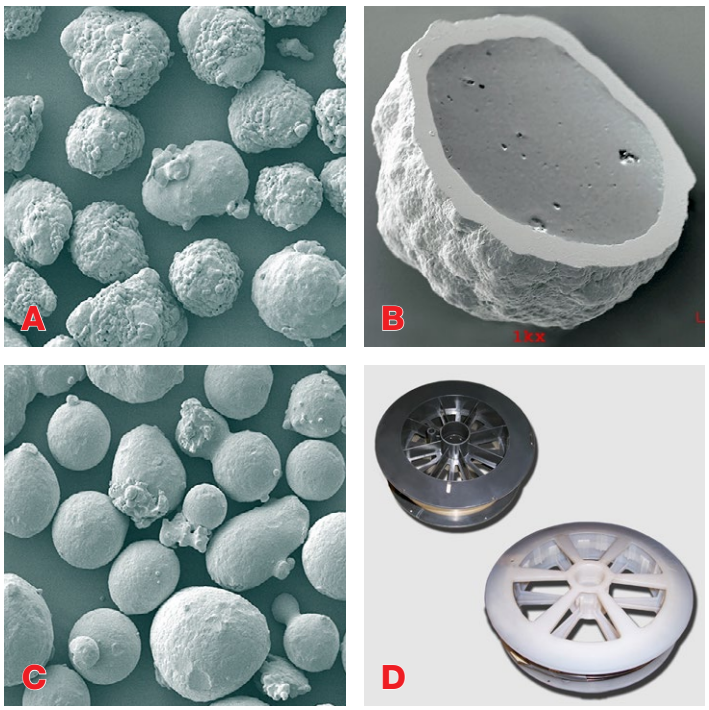
Non-exothermic materials:
These materials include powders that are gas atomized and where aluminum is a solute component of the nickel, and solid wires which are drawn from pre-alloyed nickel-aluminum.

Please refer to section 2.2 for indication of exothermic and non-exothermic materials.

1.1 Typical Uses and Applications

- Salvage and build-up for restoration applications
- High-temperature particle erosion resistance
- Oxidizing atmosphere resistance below 800 °C (1470 °F.
- Bond coat for ceramic or abradables with service temperatures up to 800 °C (1470 °F)
- Products with the addition of molybdenum enhance hot corrosion resistance at elevated temperatures

Quick Facts		
Classification		Metal, nickel-based
Chemistry		Ni Al [Mo]
Manufacture	Powders:	Mechanically clad, chemically clad or gas atomized
	Wires:	Solid drawn or composite
Morphology:	Powders:	Spheroidal
	Wires:	Cored or solid
Apparent density		2.5 to 4.5 g/cm^3
Service temperature		< 650 °C (1200 °F) or < 800 °C (1470 °F)
Purpose		Bond coat or salvage and restoration
Process	Powders:	HVOF, Atmospheric Plasma Spray or Combustion Powder Thermospray™
	Wires:	Combustion Wire Spray or Electric Arc Wire Spray



Typical morphology for powder products: **A:** mechanically clad; **B:** chemically clad; **C:** gas atomized. **D:** typical packaging for wire products.

2 Material Information

2.1 Chemical Composition

Product	Chemical Composition (wt. %)			
	Ni	Al	Mo	Other (max) [a]
Powder Products				
Amdry 956	Balance	4 to 5.5	---	2.5
Metco 450NS	Balance	4 to 5.5	---	2.5
Metco 480NS	Balance	4 to 5.5	---	1
Diamalloy 4008NS	Balance	4 to 5.5	---	1
Metco 404NS	80	20	---	N.R.
Metco 2101ZB	80	20	---	N.R.
Metco 447NS	Balance	5.5	5	3.7
Wire Products				
Metco 8400	Balance	5	---	N.R.
Metco 8405	Balance	20	---	≤ 1
Metco 405A	Balance	20	---	≤ 1
Metco 8447	Balance	5.5	5	N.R.

Note: N.R. = not reported
[a] Including organic binder for mechanically clad powders

2.2 Additional Material Characteristics

2.2.1 Powder Products

Product	Nominal Range (µm)	Apparent Density (g/cm^3)	Manufacturing Method	Morphology	Exothermic
Amdry 956	–90 +45 [a]	3.7 ±0.3	Mechanically Clad	Spheroidal	✓
Metco 450NS	–90 +45 [a]	3.7 ±0.3	Mechanically Clad	Spheroidal	✓
Metco 480NS	–90 +45 [a]	3.8 ±0.3	Gas Atomized	Spheroidal	✗
Diamalloy 4008NS	-45 +11 [b]	3.9 ±0.3	Gas Atomized	Spheroidal	✗
Metco 404NS	-90 +53 [a]	3.0 (nominal)	Chemically Clad	Spheroidal	✓
Metco 2101ZB	-125 +45 [a]	3.2 (nominal)	Chemically Clad	Spheroidal	✓
Metco 447NS	-90 +45 [a]	3.5 (nominal)	Mechanically Clad	Spheroidal	✓

[a] Size analysis via sieve (ASTM B214)
[b] Size Analysis via Microtrac by laser light diffraction per ASTM C 1070

2.2.1 Wire Products

Product	Wire Diameter	Manufacturing Method	Morphology	Exothermic
Metco 8400	1.6 mm (0.063 in)	Drawn	Solid	✗
Metco 8405	1.6 mm (0.063 in)	Composited	Cored	✓
Metco 405A	3.2 mm (0.126 in)	Composited	Cored	✓
Metco 8447	1.6 mm (0.063 in)	Composited	Cored	✓

2.3 Recommended Process

Product	APS	HVOF	CPS	CWS	EAW
Amdry 956	✓		✓		
Metco 450NS	✓		✓		
Metco 480NS	✓				
Diamalloy 4008NS	✓	✓			
Metco 404NS	✓		✓		
Metco 2101ZB	✓		✓		
Metco 447NS	✓		✓		
Metco 8400					✓
Metco 8405					✓
Metco 405A				✓	
Metco 8447					✓

APS = Atmospheric Plasma Spray, **HVOF** = High Velocity Oxygen Fuel Spray; **CPS** = Combustion Powder Thermospray; **CWS** = Combustion Wire Spray; **EAW** = Electric Arc Wire Spray

2.4 Key Selection Criteria

- Choose the product that meets the required customer material specifications.
- All products in this document produce coatings that are resistant to atmospheric corrosion with good resistance to oxidation and solid particle erosion.
- Amdry 956 and Metco 450NS are very popular choices for low temperature bond coats and general salvage and restoration on steel and nickel-based substrates when sprayed with atmospheric plasma spray or combustion powder spray.
- Metco 8400 is ideal as a corrosion-resistant bond coat for nickel-based and steel substrates and restoration on carbon steel substrates applied using electric arc wire spray.
- Metco 405A is the latest product in the long-standing Metco 405 series of wires. It is designed for very reproducible feeding and spray processing. Coatings have the same characteristics as previous products such as Metco 405NS and Metco 405NS-1.
- Metco 8405 and Metco 405A produce dense coatings that provide resistance to oxidation and mid-temperature corrosion.
- Metco 404NS and Metco 2101ZB produce a vigorous exothermic reaction during spraying for optimized bond strength.
- Metco 2101ZB has a coarser particle size distribution, that produces coatings with a greater surface roughness than Metco 404NS.
- Metco 480NS and Diamalloy 4008NS are fully alloyed products that result in coatings with better corrosion resistance and can be used in applications where corrosion resistance is critical.
- Diamalloy 4008 produce denser coatings with smooth as-sprayed surfaces when applied using HVOF.
- Metco 447NS when better resistance to scuffing or fretting is required. It also offers additional toughness.
- Choose Metco 8447 when a coating having good wear and solid particle erosion resistance is required Metco 8447 produces coatings with high strength and low shrinkage on carbon steel substrates.

2.5 Related Products

- Coatings of Metco 452 and Metco 453 have better machinability than coatings of Amdry 956 or Metco 450NS.
- Choose aluminum-clad nickel-chromium materials such as Amdry 960, Metco 443NS and Metco 461NS for coatings with better high temperature oxidation and hot corrosion resistance. These products produce an exothermic reaction only when atmospheric plasma sprayed.
- Amdry 962 series (NiCrAlY) and Amdry 995 series (CoNiCrAlY) products produce coatings with excellent oxidation and hot corrosion resistance and can withstand higher service temperatures.
- Metco 470AW is a nickel-iron-chromium wire suitable for use as a bond coat or dimensional restoration material on hardened steels, aluminum-based substrates, cast iron, nickel-based substrates and titanium-based substrates.
- Metco 8443 is a nickel-chromium-aluminum-molybdenum wire material suitable for high temperature oxidation and hot gas corrosion resistance at temperatures up to 980 °C (1800 °F).
- For increased wear resistance, consider Oerlikon Metco's extensive portfolio of carbide materials that can be applied using HVOF.
- For better sliding wear resistance at higher temperatures, consider products from our portfolio of ceramic materials that can be applied using atmospheric plasma spray.
- Please refer to the data sheets of the related products for further information.

2.6 Customer Specifications

Product	Customer Specification	
Amdry 956	Canada Pratt & Whitney CPW 247 Chromalloy BZ-003 Type 39 GKN Aerospace PM 819-37 Honeywell M3951 MTU MTS 1080 Rolls-Royce Corporation EMS 56757 Rolls-Royce OMAT 3/188 Rolls-Royce RRMS 40022 Turbomeca LA 657 Ed. 1 PA2 Ind.0	CFM International CP 6007 GE B50TF56, Cl A Honeywell EMS EMS 57746, Type 1, Class 2 Industria de Turbo Propulsores SMM-902 Pratt & Whitney PWA 1337 Rolls-Royce Corporation PMI 1163 Rolls-Royce MSRR 9507/5 Snecma DMR 33.011
Metco 450NS	Avio 4800M/3 CFM International CP 6007 GE B50A891 Honeywell EMS 57746, Type I, Class 2 Honeywell M3951 MTU MTS 1080 Pratt & Whitney PWA 1337 Rolls-Royce Corporation EMS 56757 Rolls-Royce OMAT 3/188 Rolls-Royce RRMS 40022 Snecma DMR 33.011	Canada Pratt & Whitney CPW 247 Chromalloy BZ-003 Type 39 GE B50TF56, Cl A Honeywell FP 5045, Type XV Industria de Turbo Propulsores SMM-902 Northrup Grumman GM 3010-4B, Tp IV, Gr B Praxair PS-036009 Rolls-Royce Corporation PMI 1163 Rolls-Royce MSRR 9507/5 SAE International AMS 5739 U.S. Military A-A-59315/10
Metco 480NS	Canada Pratt & Whitney CPW 490 GE B50TF56, Cl B Honeywell EMS 57746, Type I, Cl 1 Rolls-Royce MSRR 9507/5	CFM International CP 6007 (except moisture) GKN Aerospace PM 819-56 (special order) Pratt & Whitney PWA 1380
Diamalloy 4008NS	GE B50TF56, Cl C Rolls-Royce Corporation EMS 39661	Pratt & Whitney PWA 36334-1S
Metco 404NS	CFM International CP 6005 Chromalloy C-72 GE B50TF33, Cl A GKN Aerospace PM 819-21 Honeywell FP 5045, Type I MTU MTS 1073 Rolls-Royce MSRR 9507/4 U. S. Military USAF 67A60753, Type P-3	Chromalloy BZ-003, Type 2 Chromalloy RCC No. 1 GE P6-TE957 Honeywell EMS 57746, Type II, Cl 2 Honeywell M3952 Pratt & Whitney PWA 1321 Snecma DMR 33.010
Metco 2101ZB	GE B50TF13, Cl A and B	
Metco 447NS	Chromalloy BZ-003 Type 57 GE B50TF166, Class A Honeywell EMS 57749, Type 11, Class 2 Honeywell M396 Rolls-Royce OMAT 3/179 Rolls-Royce RRMS 40040 U.S. Military MIL-P-83348 Type 1, Comp. FF, Cl. 2	Dana Perfect Circle PC 110-265 GKN Aerospace 819-24 Honeywell FP 5045, Type XVI MTU MTS 1079 Rolls-Royce MSRR 9507/35 U.S. Military A-A 59315/15
Metco 8400	GE B50TF56 * GKN Aerospace PM 819-70 Pratt & Whitney PWA 36937	GE Std. Prac. 70-49-39 C07-042 Honeywell FP 5045, Type XV Rolls-Royce OMAT 3/229A
Metco 405A	Airbus ABS5995 Pratt & Whitney PWA 1334 (except wire diameter) Rolls-Royce OMAT 3/90	American Welding Society AWS C2.25/C2.25M W-Ni-Al-2 Rolls-Royce RRMS 40016 (except wire diameter)
Metco 8447	Rolls-Royce OMAT 3/272 Rolls-Royce RRMS 40091	

* Meets the requirements of the specification except chemistry “total all others” = 1.2 %. Not approved for this specification.

3 Coating Information

3.1 Key Thermal Spray Coating Information

Product	Maximum Service Temperature		Recommended Finishing Method
	°C	°F	
Amdry 956	800	1470	Grind
Metco 450NS	800	1470	Grind
Metco 480NS	800	1470	Machine or Grind
Diamalloy 4008NS	800	1470	Grind
Metco 404NS	650	1200	Grind
Metco 2101ZB	650	1200	Grind
Metco 447NS	650	1200	Grind
Metco 8400	800	1470	Machine or Grind
Metco 8405	650	1200	Machine or Grind
Metco 405A	650	1200	Machine or Grind
Metco 8447	650	1200	Machine or Grind

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.

3.3 Recommended Spray Guns

Atmospheric Plasma	Combustion Powder	HVOF	Electric Arc Wire	Combustion Wire
Metco 3MBM	Metco 5P-II	DiamondJet series	SmartArc PPG	Metco 16E
Metco 9MBM	Metco 6P-II series	WokaJet series	Metco LD/U2	Metco 5K
Metco 11MB		WokaStar series	Metco LD/U3	
Metco F4MB-XL series			Metco LD/Schub 5	
Metco SM F-100 Connex				
Metco SM F-210				
TriplexPro series				
SinplexPro series				

4 Commercial Information

4.1 Ordering Information and Availability

Product	Order No.	Wire Diameter (if applicable)	Package Size	Package Type	Availability	Distribution
Powders:						
Amdry 956	1001049	---	5 lb (approx. 2.25 kg)	Plastic Jar	Stock	Global
Metco 450NS	1000089	---	5 lb (approx. 2.25 kg)	Plastic Jar	Stock	Global
Metco 480NS	1000576	---	5 lb (approx. 2.25 kg)	Plastic Jar	Stock	Global
Diamalloy 4008NS	1000801	---	5 lb (approx. 2.25 kg)	Plastic Jar	Stock	Global
Metco 404NS	1000060	---	5 lb (approx. 2.25 kg)	Plastic Jar	Stock	Global
Metco 2101ZB	1043511	---	10 lb (approx. 4.5 kg)	Plastic Jar	Stock	Global
Metco 447NS	1000397	---	5 lb (approx. 2.25 kg)	Plastic Jar	Stock	Global
Wires:						
Metco 8400	1001075	1.6 mm (0.063 in)	25 lb (approx. 11.3 kg)	Dorn Spool	Stock	Global
Metco 8405	1071795	1.6 mm (0.063 in)	15 kg (approx. 33 lb)	Dorn Spool	Special Order	Global
Metco 405A	1508204	3.2 mm (0.126 in)	5 kg (approx. 11 lb)	Special Plastic Spool	Stock	Global
Metco 8447	1019951	1.6 mm (0.063 in)	25 lb (approx. 11.3 kg)	Dorn Spool	Stock	Global

4.2 Handling Recommendations

- Store in the original container in a dry location.
- Remove desiccant prior to use, if applicable.
- For powder products:
  - Carefully tumble contents prior to use to prevent segregation, but avoid breakdown of friable components for mechanically clad products.
  - Open containers of powder should be stored in a drying oven at temperatures to prevent moisture pickup.
- Powder-filled composite wires may be prone to moisture pickup and must be stored in a dry environment.
  - Avoid temperature fluctuations of greater than 5 °C (9 °F).
  - Maintain storage at a humidity level of ≤ 60 % at 15 to 25 °C (59 to 77 °F) or ≤ 50 % at 25 to 35 °C (77 to 95 °F).
  - Do not store for more than 5 years. Older wire should be redried.
  - If slightly affected by moisture, the wire may be redried at a temperature of 150 °C (300 °F) for 6 h. Longer drying times of up to 12 h at temperatures up to 200 °C (390 °F) can be employed if necessary. Redry no more than 6 times.
  - Wires exposed to severe water contamination, exposed to the atmosphere for long periods and/or exhibit oxidation or corrosion cannot be redried and should be scrapped.

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 Metco web site at www.oerlikon.com/metco (Resources – Safety Data Sheets).

Product	SDS No.
Amdry 956	50-793
Metco 450NS	50-180
Metco 480NS	50-187
Diamalloy 4008NS	50-187
Metco 404NS	50-161
Metco 2101ZB	50-999
Metco 447NS	50-177
Metco 8400	50-516
Metco 8405	50-215
Metco 405A	50-215
Metco 8447	50-568

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