

Material Product Data Sheet

Nickel – 5 % Aluminum Thermal Spray Powders

Thermal Spray Powder Products:
Amdry 956, Metco 450NS, Metco 450P,
Metco 480NS, Diamalloy 4008NS

1 Introduction

Coatings of Amdry™ 956, Metco™ 450NS, Metco 450P, Metco 480NS and Diamalloy™ 4008NS are general purpose materials for restoration of worn or mismachined components. They are also used as bond coats for OEM-specified and general industrial applications under top coats such as ceramics and compressor abrasives. Nickel aluminum coatings have good oxidation resistance up to 800 °C (1470 °F).

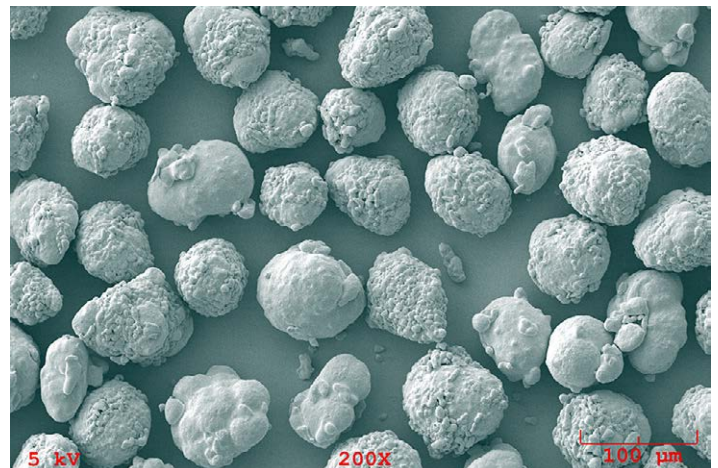
Amdry 956, Metco 450NS and Metco 450P exhibit an exothermic reaction during the spray process and are considered self-bonding to steel substrates. These powders are mechanical clad composites of aluminum and nickel. Metco 480NS and Diamalloy 4008NS powders are gas atomized. They also result in dense, well-bonded coatings, but are recommended for more critical corrosion applications than Amdry 956 or Metco 450NS. Diamalloy 4008NS has a finer particle size distribution and is designed for the HVOF spray process. Amdry 956, Metco 450NS, Metco 450P and Metco 480NS are designed to be applied using atmospheric plasma spray or combustion powder Thermospray™ processes.

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 abrasives with service temperatures up to 800 °C (1470 °F).

Quick Facts

| | |
|---------------------|--|
| Classification | Metal, nickel-based |
| Chemistry | Ni 5Al |
| Manufacture | Mechanically clad or gas atomized |
| Morphology | Spheroidal |
| Apparent density | 3.5 – 4.5 g/cm ³ |
| Service temperature | < 800 °C (1470 °F) |
| Purpose | Bond coat or restoration |
| Process | HVOF, Atmospheric Plasma Spray or Combustion Powder Thermospray™ |



Mechanically Clad (top), Gas Atomized (bottom)

2 Material Information

2.1 Chemical Composition

| Product | Chemical Composition (wt. %) | | |
|------------------|------------------------------|-----------|-------------|
| | Ni | Al | Other (max) |
| Amdry 956 | Balance | 4.0 – 5.5 | 2.5 |
| Metco 450NS | Balance | 4.0 – 5.5 | 2.5 |
| Metco 450P | Balance | 3.0 – 4.5 | 2.5 |
| Metco 480NS | Balance | 4.0 – 5.5 | 1 |
| Diamalloy 4008NS | Balance | 4.0 – 5.5 | 1 |

2.2 Additional Powder Characteristics

| Product | Nominal Range (µm) | Screen Analysis (%) | |
|-------------|--------------------|---------------------|--------------|
| | | +88 µm (max) | -44 µm (max) |
| Amdry 956 | -90 +45 | 3 | 5 |
| Metco 450NS | -90 +45 | 3 | 5 |
| Metco 450P | -90 +45 | 3 | 5 |
| Metco 480NS | -90 +45 | 3 | 5 |

| Product | Nominal Range (µm) | Microtrac Analysis (% cumulative) | | | |
|------------------|--------------------|-----------------------------------|--------------|--------------|--------------|
| | | +62 µm (max) | +44 µm (max) | +22 µm (max) | -16 µm (max) |
| Diamalloy 4008NS | -45 +11 | 0.2 | 13 | 80 | 4 |

Microtrac by laser light diffraction per ASTM C 1070; screen analysis per ASTM Standard B214

2.3 Other Physical Properties

| Product | Apparent Density (g/cm ³) | Manufacture | Morphology |
|------------------|---------------------------------------|-------------------|------------|
| Amdry 956 | 3.7 ± 0.3 | Mechanically Clad | Spheroidal |
| Metco 450NS | 3.7 ± 0.3 | Mechanically Clad | Spheroidal |
| Metco 450P | 3.7 ± 0.3 | Mechanically Clad | Spheroidal |
| Metco 480NS | 3.8 ± 0.3 | Gas Atomized | Spheroidal |
| Diamalloy 4008NS | 3.9 ± 0.3 | Gas Atomized | Spheroidal |

2.4 Key Selection Criteria

- Choose the product that meets the required customer material specifications.
- Amdry 956, Metco 450NS and Metco 450P create an exothermic reaction during spraying, that result in a quasi-metallurgical bond with some substrates such as steels.
- 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.
- Metco 450P is a premium grade composite that has been designed to produce coatings that are more readily machined than coatings of Amdry 956 or Metco 450NS. Metco 450P is recommended for applications where grinding is undesirable.
- Amdry 956, Metco 450NS, Metco 450P and Metco 480NS can be applied using atmospheric plasma spray or combustion powder Thermospray™ thermal spray processes.

- Diamalloy 4008NS is sized for application with the HVOF spray process and results in denser coatings with finer as-sprayed and machined surface finishes.

2.5 Related Products

- Coatings of Metco 452 and Metco 453 have better machinability than coatings of Amdry 956 or Metco 450NS.
- Amdry 960, Metco 443NS and Metco 461NS produce coatings with better high temperature oxidation and hot corrosion resistance than coatings of products in this data sheet.
- Amdry 962 and Amdry 995 series of products produce coatings with excellent oxidation and hot corrosion resistance and higher service temperatures.
- Diamalloy 4700 is a high temperature, oxidation resistant alternative to Diamalloy 4008NS, which is also suitable for HVOF application.
- 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 1080 Rolls-Royce Corporation EMS 56757 Rolls-Royce OMAT 3/188A Rolls-Royce plc RRMS 40022 Turbomeca LA 657 Ed. 1 PA2 Ind.0 CFM International CP 6007 GE B50TF56, CI A Honeywell EMS EMS 57746, Type 1, Class 2 Industria de Turbo Propulsores SMM-902 MTU MTS Pratt & Whitney PWA 1337 Rolls-Royce Corporation PMI 1163 Rolls-Royce plc MSRR 9507/5 Snecma DMR 33.011 Williams WIMS 644 |
| 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 plc RRMS 40022 Snecma DMR 33.011 Williams WIMS 644 Canada Pratt & Whitney CPW 247 Chromalloy BZ-003 Type 39 GE B50TF56, CI 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 plc MSRR 9507/5 SAE International AMS 5739 U.S. Military MIL-P-83348, Comp H, Tp 1, CI 2 |
| Metco 450P | Rolls-Royce plc MSRR 9507/43 |
| Metco 480NS | Canada Pratt & Whitney CPW 490 GE B50TF56, CI B Honeywell EMS 57746, Type I, CI 1 Rolls-Royce plc MSRR 9507/5 CFM International CP 6007 (except moisture) GKN Aerospace PM 819-56 (special order) Pratt & Whitney PWA 1380 |
| Diamalloy 4008NS | GE B50TF56, CI C Rolls-Royce Corporation EMS 39661 Pratt & Whitney PWA 36334-1S |

3 Coating Information

3.1 Key Thermal Spray Coating Information

All data is approximate and will vary depending on spray process, coating equipment and parameters used.

| | | Amdry 956 | Metco 450NS | Metco 450P | Metco 480NS | Diamalloy 4008 |
|--|-------------------|----------------------|------------------------|-----------------------|------------------------|---------------------------|
| Recommended coating processes ^a | | APS or CP | APS or CP | APS or CP | APS or CP | HVOF |
| Macrohardness | | 65 – 80 HRB | 65 – 80 HRB | 65 – 75 HRB | 65 – 80 HRB | 25 HRC |
| Typical porosity | vol. % | < 5 | < 5 | < 5 | < 5 | < 3 |
| Density | g/cm ³ | 7.2 – 7.4 | 7.2 – 7.4 | 7.2 – 7.4 | 7.2 – 7.4 | 7.2 – 7.4 |
| Max service temp. | °C | 800 | 800 | 800 | 800 | 800 |
| | °F | 1470 | 1470 | 1470 | 1470 | 1470 |
| Bond strength (min) ^b | MPa | 20.7 | 20.7 | 20.7 | 68.9 | 62.0 |
| | psi | 3000 | 3000 | 3000 | 10000 | 9000 |
| Recommended finishing | | Grind | Grind | Machine | Machine / Grind | Grind |
| Surface roughness (Ra) | | | | | | |
| As sprayed | µm | 11.4 – 15.2 | 11.4 – 15.2 | 11 – 17 | 12.7 – 17.9 | 6.3 – 8 |
| | µin | 450 – 600 | 450 – 600 | 450 – 650 | 500 – 700 | 250 – 350 |
| Machined | µm | --- | --- | 0.6 – 1.0 | 2.5 3.8 | --- |
| | µin | --- | --- | 25 – 40 | 100 – 150 | --- |
| Ground | µm | 0.30 – 0.36 | 0.30 – 0.36 | – | 0.15 – 2.0 | 1 – 1.5 |
| | µin | 12 – 14 | 12 – 14 | – | 6 – 8 | 40 – 60 |

^a APS = Atmospheric Plasma Spray; CP = Combustion Powder Thermospray; HVOF = High Velocity Oxy-Fuel Spray

^b Low carbon steel, ground substrate, plasma sprayed

3.3 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 | HVOF |
| Metco 3MB series | Metco 5P-II | DiamondJet series |
| Metco 9MB series | Metco 6P-II series | WokaJet series |
| Metco 11MB | | |
| Metco F4 series | | |
| 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. | Package Size | Availability | Distribution |
|------------------|--------------------|---|------------------------|------------------|
| Amdry 956 | 1001049 | 5 lb (approx. 2.25 kg) | Stock | Global |
| Metco 450NS | 1000089 1000130 | 5 lb (approx. 2.25 kg) 25 lb (approx. 11.3 kg) | Stock Special Order | Global Global |
| Metco 450P | 1000439 | 5 lb (approx. 2.25 kg) | Special Order | Global |
| Metco 480NS | 1000576 | 5 lb (approx. 2.25 kg) | Stock | Global |
| Diamalloy 4008NS | 1000801 | 5 lb (approx. 2.25 kg) | Stock | Global |

4.2 Handling Recommendations

- Store in the original container in a dry location.
- Carefully tumble contents prior to use to prevent segregation, but avoid breakdown of friable components.
- Open containers should be stored in a drying oven at temperatures 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 Metco web site at www.oerlikon.com/metco (Resources – Safety Data Sheets).

| Product | SDS No. |
|------------------|---------|
| Amdry 956 | 50-793 |
| Metco 450NS | 50-180 |
| Metco 450P | 50-180 |
| Metco 480NS | 50-187 |
| Diamalloy 4008NS | 50-187 |

Information is subject to change without prior notice.