

Material Product Data Sheet

Nickel Chromium Aluminum Cobalt Ytria Composite Powder

Thermal Spray Powder Products: Metco 461NS

1 Introduction

Metco™ 461NS is a patented nickel chromium aluminum cobalt yttria composite powder designed to produce self-bonding coatings that can be used for oxidation and corrosion resistant applications at temperatures up to 980 °C (1800 °F).

Plasma sprayed coatings of Metco 461NS can be utilized either as a protective barrier to hot corrosion environments or as a bond coat for ceramic thermal barrier coating applications.

The addition of chromium promotes oxidation resistance. The addition of aluminum and cobalt enhances the self-bonding properties of Metco 461NS coatings to the substrates and overcomes the poor bonding characteristics typical of nickel-chromium alloys due to high residual stresses within the coatings.

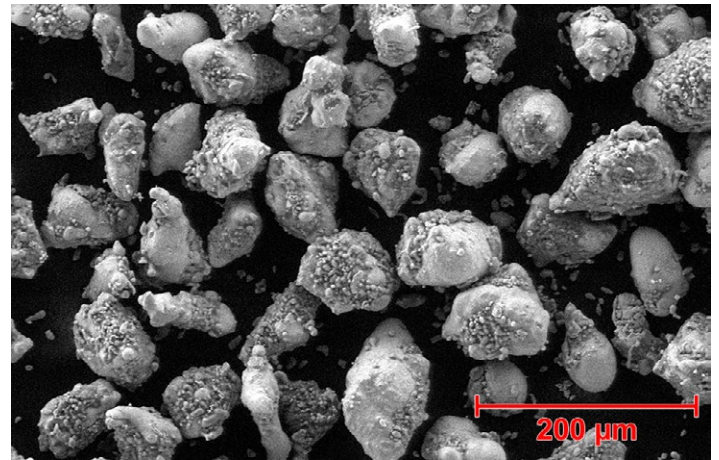
Aluminum also improves the high temperature oxidation resistance of the Metco 461NS coatings. Ytria reacts with the aluminum during spraying to promote the formation of a ductile complex ceramic oxide, $Al_2O_3-Y_2O_3$, which improves the high temperature cohesive strength of the coating and aids in applications where flexing is an important consideration.

1.1 Typical Uses and Applications

- Salvage and buildup on mis-machined or worn parts made of corrosion resistant steels, machinable carbon steels, nickel alloys or iron
- Exhaust mufflers and heat treating fixtures for oxidation resistance

Quick Facts

| | |
|---------------------|--|
| Classification | Composite, nickel-based |
| Chemistry | Ni 17.5Cr 5.5Al 2.5Co 0.5YO |
| Manufacture | Mechanically clad |
| Morphology | Irregular |
| Apparent Density | 2.5 – 4.0 g/cm ³ |
| Melting Point | 660 °C (1215 °F) |
| Service Temperature | ≤ 980 °C (1800 °F) |
| Purpose | High temperature oxidation and corrosion resistance |
| Process | Atmospheric plasma spray or combustion powder Thermospray™ |



SEM Photomicrograph of Metco 461NS showing the morphology of this composite powder product

2 Material Information

2.1 Chemical Composition

| Product | Nominal Chemical Composition (wt. %) | | | | | | |
|-------------|--------------------------------------|-------------|-----------|-----------|-------------------------------|--------------|----------------|
| | Ni | Cr | Al | Co | Y ₂ O ₃ | Others (max) | Organics (max) |
| Metco 461NS | Bal. | 14.0 – 20.0 | 2.0 – 8.0 | 1.0 – 5.0 | 0.3 – 1.2 | 6.5 | 5.5 |

2.2 Particle Size Distribution and Other Properties

| Product | Nominal Particle Size Distribution (µm) | Manufacturing Method | Morphology |
|-------------|---|----------------------|------------|
| Metco 461NS | -150 +45 | Mechanically Clad | Irregular |

Upper particle size via sieve analysis in accordance with ASTM B214; lower particle size analysis via laser diffraction (Microtrac). Other particle size distributions are available on request.

2.3 Key Selection Criteria

■ Metco 461NS can be used for high temperature oxidation and corrosion resistant coatings. Coatings of Metco 461NS are self-bonding and have improved ceramic ductility due to the formation of Al₂O₃-Y₂O₃.

2.4 Related Products

■ Metco 443NS, Amdry 960 and Amdry 510 are nickel chromium aluminum composite powders. Coatings of these powders are used for oxidation and corrosion resistant (e.g., resist corrosive gases, etc.) applications at temperatures up to 980 °C (1800 °F). However, Metco 461NS is preferred for improved oxidation and hot corrosion resistance.

■ Metco 442 and Metco 444 are both self-bonding stainless composite powders. Coatings of these powders can be used as wear and corrosion resistant coatings. Coatings of Metco 442 exhibit higher macrohardness; however, the maximum service temperature Metco 442 coatings is 760 °C (1400 °F), and that of Metco 444 coatings is 870 °C (1600 °F).

■ Oerlikon Metco also offers a wide range of MCrAlY alloy products ("M" represents either nickel or cobalt or both). Atmospheric plasma, HVOF or controlled atmosphere plasma coatings of these materials exhibit excellent high temperature oxidation and hot corrosion resistance and can also be used as protective bond coats for thermal barrier ceramic top coats.

3 Coating Information

3.1 Key Thermal Spray Coating Information

| Specification | Typical Data | |
|---------------------------------|--|---------------------------------|
| Recommended Spray Process | Atmospheric plasma spray or combustion powder Thermospray™ | |
| Macrohardness | 80 – 100 HRB | |
| Microhardness | 175 – 250 HV300 | |
| Density | 6.8 – 7.0 g/cm ³ | |
| Porosity | 2 – 10 vol. % | |
| Oxide Content | 5 – 25 vol. % | |
| Thermal Conductivity | 20 – 30 W/m-K | |
| Coefficient of Linear Expansion | 13 x 10 ⁻⁶ cm/cm °C | 7.2 x 10 ⁻⁶ in/in °F |
| Maximum Service Temperature | 870 °C | 1600 °F |

Data is provided is typical and variability can be expected. Changes in spray process, spray equipment or spray parameters can significantly change coating results.

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 9MB series | Metco 5P-II |
| Metco F4 series | Metco 6P-II series |
| TriplexPro series | |
| SimplexPro series | |

4 Commercial Information

4.1 Ordering Information and Availability

| Product | Order No. | Package Size | Availability | Distribution |
|-------------|-----------|------------------------|--------------|--------------|
| Metco 461NS | 1000601 | 5 lb (approx. 2.25 kg) | Stock | Global |

4.2 Handling Recommendations

- Store in the original container in a dry location.
- Tumble contents gently prior to use to prevent segregation.
- Open containers should be stored in a drying oven to prevent moisture pickup.

4.3 Safety Recommendations

See SDS 50-184 (Safety Data Sheet) in the localized version applicable to 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).

Information is subject to change without prior notice.