

Material Product Data Sheet

CoNiCrAlY-BN / Polyester Abradable Thermal Spray Powders

Powder Products: Metco™ 2042 and Metco 2043

1 Introduction

Oerlikon Metco's CoNiCrAlY-Boron Nitride / Polyester spray-dried composite powders were developed to produce abradable coatings for clearance control applications in the high pressure compressor section of jet engines and industrial gas turbines where rotating components may come into contact with the coating as a result of design intent or operational surges. The coatings minimize wear to rotating components while maximizing gas path efficiency.

The CoNiCrAlY (cobalt-nickel-chromium-aluminum-yttrium) matrix within coatings of these materials provides improved oxidation and corrosion resistance compared to other nickel-chromium-based abradable materials. The boron nitride component provides solid lubrication, thereby improving abradability and reducing blade wear during rub incursions. Coating porosity can vary from 35 to 60 vol. %; which is controlled through the amount of entrapped polyester in the coating. It is this controlled, web-like metallic structure that allows for excellent friability against titanium alloy, steel or superalloy components.

It is strongly recommended that these coatings undergo a post-spray heat treatment to remove the polyester component and create porosity within the coating structure, improving abradability.

Coatings can be used at service temperatures up to 750 °C (1380 °F); however, an increased susceptibility to oxidation can be expected above 650 °C (1200 °F). For use under extreme environmental conditions or when hard, erosion resistant coatings are required, hard tipped mating blades or knife edges are recommended. Coatings of Metco 2042 and Metco 2043 are readily cut by bare, untipped nickel alloys and stainless steel components at service temperatures up to 650 °C (1200 °F). For use against bare, untreated titanium components, Metco 2042 is recommended at service temperatures up to 550 °C (1020 °F).

Quick Facts

| | |
|-----------------------|-----------------------------|
| Classification | Abradable, cobalt-based |
| Chemistry | CoNiCrAlY-BN-Polyester |
| Manufacture | Agglomerated and blended |
| Morphology | Spheroidal |
| Purpose | Clearance control coatings |
| Apparent Density | 3.2 ± 0.3 g/cm ³ |
| Service Temperature * | ≤ 750 °C (1380 °F) |
| Process | Atmospheric Plasma Spray |

* See Section 3.1



1.1 Typical Uses and Applications

Abradable coatings for:

- High pressure compressor stages (titanium-based or nickel-based alloy blades)
- Labyrinth shaft and disk seals

2 Material Information

2.1 Chemical Composition

| Product | Weight Percent (nominal) | | | | | | | |
|------------|--------------------------|--------|----------|----------|---------|---------------|-----------|----------------|
| | Cobalt | Nickel | Chromium | Aluminum | Yttrium | Boron Nitride | Polyester | Organic Solids |
| Metco 2042 | 29 | 24 | 16 | 6 | 0.3 | 7 | 14 | 3 |
| Metco 2043 | 30 | 25 | 16 | 6 | 0.3 | 4 | 15 | 3 |

2.2 Particle Size Distribution

| Product | Nominal Range μm | D90 | D50 | D10 |
|------------|-----------------------------|-----|-----|-----|
| Metco 2042 | -176 +7.8 | 190 | 85 | 45 |
| Metco 2043 | -176 +11 | 140 | 75 | 35 |

Upper particle size analysis using sieve in accordance with ASTM B214; lower size analysis using laser diffraction (Microtrac)

2.3 Key Selection Criteria

- Metco 2042 is recommended for applications using bare, untipped titanium alloy blades operating at service temperatures up to 550 °C (1022 °F).
- Metco 2043 is recommended for compatibility with steel and nickel-based superalloy blades.
- Metco 2043 produces harder and more erosion resistant coatings.
- Metco 2042 has a coarser particle size distribution and the powder contains more hBN than Metco 2043. The additional hBN enhances abrasability.
- Always choose the material that meets the customer material and process specifications.

2.4 Related Products

- Metco 2042 and Metco 2043 are plasma-sprayed alternatives to products such as Metco 301NS, Metco 301C-NS, Metco 314, Durabrade 2313, Metco 312 and Durabrade 2311.
- Coatings of Metco 2042 and Metco 2043 exhibit improved corrosion resistance versus Metco 320NS, Metco 313 and Ni-Graphite coatings (Metco 307, Metco 308, Metco 309, Durabrade 2221, Durabrade 2223 and Durabrade 2241).
- Coatings of Metco 2042 and Metco 2043 can be used at higher service temperatures than coatings of the previously mentioned nickel graphite materials and NiCrAl-Bentonite materials (Metco 314NS, Metco 312NS, Durabrade 2313 and Durabrade 2311).

2.5 Customer Specifications

| Product | Customer Specification |
|------------|--|
| Metco 2042 | Honeywell EMS 57762 MTU MTS 1452 Cond. B Pratt & Whitney PMC 5124 Pratt & Whitney PWA 36294-1S |
| Metco 2043 | Alstom HTCT 601844 Rolls-Royce Corporation EMS 56768 Rolls-Royce plc RRMS 40028 Snecma DMR 33.101 |

3 Coating Information

3.1 Key Thermal Spray Coating Information

| Specification | | Metco 2042 | Metco 2043 |
|--|------------------------------|--|--|
| Recommended Process | | Atmospheric Plasma Spray | Atmospheric Plasma Spray |
| Color As Sprayed | | Gray | Gray |
| Recommend Bond Coat Materials ^a | | Metco 450NS, Metco 480NS, Amdry 956, Amdry 995C, Amdry 962 | Amdry 962, Amdry 995C |
| Machined Surface Profile Ra (approx) | µm | 3 – 4 | 3 – 4 |
| | µin | 100 – 150 | 100 – 150 |
| Macrohardness Guidelines | | Against Bare Ti Components | Against Bare Steel or Ni-Alloy Components |
| As Sprayed ^b | HR15Y | 58 – 65 | 75 – 85 |
| Heat Treated | HR15Y | 30 – 50 | 65 – 75 |
| Density | g/cm ³ | 3.0 | 3.2 |
| Minimum Bond Strength | MPa | 3.4 | 6.9 |
| | psi | 500 | 1000 |
| Thickness Limit ^c | mm | > 3 | > 4 |
| | in | > 0.125 | > 0.157 |
| Coating Weight | kg/m ² /0.1 mm | 0.3 | 0.34 |
| | lb/ft ² /0.001 in | 0.016 | 0.0187 |
| Porosity ^d | vol % | 50 – 60 | 35 – 45 |
| Maximum Service Temperatures | | | |
| Against hard tipped component ^e | °C | 750 | 750 |
| | °F | 1380 | 1380 |
| Against bare Ti components | °C | 550 | not recommended |
| | °F | 1020 | not recommended |
| Against bare Ni-alloy or stainless steel | °C | 650 | 650 |
| | °F | 1200 | 1200 |

^a Many customer coating specifications specify proprietary MCrAlY bond coat materials available to authorized users. Please check with your Oerlikon Metco Account Representative for availability.

^b Data provided for reference only. It is not recommended to use Metco 2042 or Metco 2043 coatings in the as-sprayed condition against bare titanium, steel or nickel-alloy components.

^c Processing of complex geometries or internal diameters may further limit the maximum coating thickness achievable.

^d This is an indication of coating macro porosity (post heat treated condition), measured on standard metallographic section of sprayed coating.

^e Increased susceptibility to oxidation at temperatures above 650 °C (1200 °F) can be expected.

3.2 Post-Coating Polyester Removal

Post-coat heat treat Metco 2042 and Metco 2043 coatings to “burn-out” or remove the polyester entrapped within the coating structure. These materials have been engineered such that post-coating removal of the polyester will leave behind an interconnected metal matrix, which is the desired structure for optimal abrasability.

The heat treatment cycle may vary based on part geometry, coating thickness and part size. Verify that the polyester has been removed using a technique such as TGA (Thermo Gravimetric Analysis). The recommended heat treatment cycle is as follows:

Recommended Heat Treatment Cycle

| | |
|------------|---|
| Atmosphere | Air with proper exhaust |
| Ramp up | Room temperature to 500 °C (932 °F) at 5 °C/min (9 °F/min) in approximately 1.5 h |
| Heat soak | 500 °C (932 °F) for 3.5 h |
| Ramp down | 500 °C (932 °F) to ambient temperature in approximately 2 h |

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 Atmospheric Plasma Spray Guns

TriplexPro series

SinplexPro series

Metco F4MB-XL series

Metco 9MBM

4 Commercial Information

4.1 Ordering Information and Availability

| Product | Order No. | Package Size | Availability | Distribution |
|------------|-----------|------------------------|--------------|--------------|
| Metco 2042 | 1001610 | 5 lb (approx. 2.25 kg) | Stock | Global |
| Metco 2043 | 1001595 | 5 lb (approx. 2.25 kg) | Stock | Global |

4.2 Handling Recommendations

- Store in the original container in a dry location.
- Open containers should be stored in a drying oven at temperatures below 38 °C (100 °F) to prevent moisture pickup.
- Tumble contents prior to use to prevent segregation.
- Damp powder can be dried by spreading powder on a flat metal pan, approximately 13 mm (0.5 in) thick and heated to approximately 65 °C (150 °F) for one hour prior to use.

4.3 Safety Recommendations

See SDS 50-556 (Safety Data Sheet) in the version 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).