oerlikon
metco

Material Product Data Sheet
Nickel Chromium Aluminum Molybdenum Iron Composite Thermal Spray Powders

Thermal Spray Powder Products:
Metco 442, Metco 444

1 Introduction

Metco™ 442 and Metco 444 are stainless composite powders of nickel, chromium, molybdenum and aluminum for thermal spray. Nickel and chromium promote resistance to oxidation and high temperature corrosion. Partial oxidation of the molybdenum constituent provides scuff and sliding wear resistance. Aluminum promotes oxidation resistance.

Aluminum in combination with nickel produces an exothermic reaction when sprayed that leads to very good bond strength and interparticle bonding. Thick coatings of these materials can be applied without cracking or delamination, even when applied using combustion powder Thermospray™. Thin coatings can be applied with minimal surface preparation.

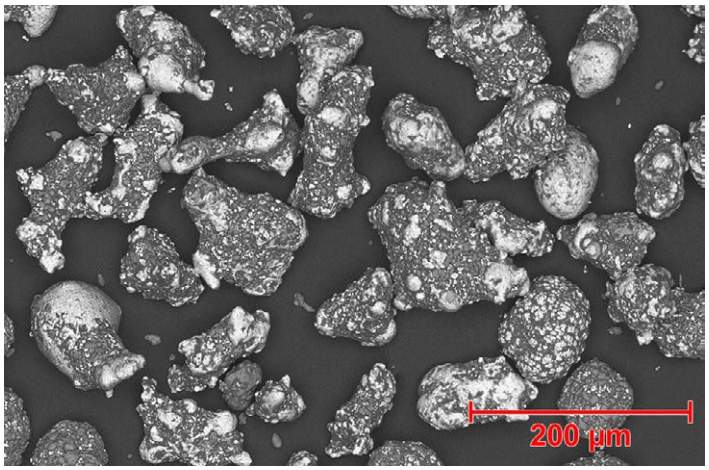
Metco 442 contains boron and silicon, which are added to improve overall hardness through the formation of hard precipitates of nickel and chromium borides and silicides in the coating, as well as creating low melting point phases that gives it its self-fluxing capability and improved abrasive wear resistance. Metco 442 produces hard coatings that can be ground to very good finishes.

Metco 444 produces coatings of moderate hardness that can be machined to good finishes and can withstand significantly higher service temperatures than coatings of Metco 442.

1.1 Typical Use and Applications

- Salvage and restoration
- Bond coat for other thermal sprayed coatings
- “One-step coating” (no need for a bond coat)
- Hard bearing surfaces such as bearing journals, fuel pump rotors and sleeves
- Machine bedways and wear rings for fretting resistance (intended motion)
- Jet engine parts for fretting resistance (no intended motion)
- Exhaust fans, hydroelectric valves for low temperature particle erosion (Metco 444)

Quick Facts		
Classification	Composite, nickel-based	
Chemistry	NiCrAlMo composites	
Manufacture	Mechanically clad	
Morphology	Irregular	
Apparent density	3.1 – 3.6 g/cm^3	
Service Temperature	Metco 442:	≤ 760 °C (1400 °F)
	Metco 444:	≤ 870 °C (1600 °F)
Purpose	Wear, corrosion, erosion protection and salvage	
Process	Atmospheric plasma spray or combustion powder Thermospray™	



SEM Photomicrograph of Metco 444 showing the typical exterior morphology of these powder products

2 Material Information

2.1 Chemical Composition

Product	Nominal Chemical Composition (wt. %)									
	Ni	Cr	Mo	Fe	Al	Al_2O_3	B	Si	Others (max)	Organics (max)
Metco 442	Bal.	9	5	2	6	3	2	2	NR	NR
Metco 444	Bal.	7 – 12	2.5 – 9	3 – 7.5	2.5 – 9	–	–	–	4	3

NR = Not Reported

2.2 Particle Size Distribution and Other Properties

Product	Nominal Particle Size Distribution (µm)	Manufacturing Method	Morphology	Apparent Density (g/cm^3)
Metco 442	–125 +45	Mechanically Clad	Irregular	3.15
Metco 444	–125 +45	Mechanically Clad	Irregular	3.1 – 3.6

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

2.3 Key Selection Criteria

- Choose these materials for stainless-type coatings with good wear, corrosion and oxidation resistance.
- Both materials produce “one-step” coatings that are not highly technique dependent.
- Both materials can be applied with minimum preparation requirements and can produce thin coatings or thick coatings without cracking.
- Choose Metco 442 when coatings of higher hardness are needed and finishing by grinding is acceptable.
- Choose Metco 444 when a machinable coating is desired, or when a coating of somewhat higher service temperature is required.
- When higher bond strength, high temperature oxidation resistance and/or corrosion resistance is required, nickel aluminum alloy coatings, such as those produced using Metco 450NS or Amdry 956, are superior to coatings of Metco 442. On the other hand, coatings of Metco 442 or Metco 444 offer better wear resistance and maintain fair oxidation resistance with quite good bond strength.
- Oerlikon Metco also offers iron-based machineable and self-bonding materials, such as Amdry 959, Metco 452 and Metco 453 for cases were less corrosion resistance is required.
- Coatings of Metco 350NS have superior abrasive wear resistance compared to coatings of Metco 442 and Metco 444, but inferior bond strength, corrosion resistance and oxidation resistance.
- Pure molybdenum powders, such as Amdry 313X, Metco 63NS or Metco 4207, can be better options for coatings where better sliding wear properties are required.

2.4 Related Products

- If higher service temperature or better oxidation resistance is required, choose Metco 443NS or Amdry 960. These are aluminium clad nickel chromium alloy composite powders with maximum service temperatures of 980 °C (1800 °F). However, Metco 442 and Metco 444 offer better wear resistance.

2.5 Customer Specifications

Metco 444	Chromalloy BZ-003 Type 45 Honeywell EMS 52432, Class XXIX Honeywell M3976 Rolls-Royce Corporation EMS 56762 Rolls-Royce Corporation PMI 1270

3 Coating Information

3.1 Key Thermal Spray Coating Information

Specification	Metco 442		Metco 444	
Recommended Spray Process	Atmospheric plasma spray or combustion powder Thermospray™			
Surface Roughness RA				
As-Sprayed	10 – 20 µm	400 – 800 µin	9 – 20 µm	350 – 800 µin
Machined	–	–	1.0 – 1.8 µm	40 – 70 µin
Ground (60 grit SiC)	0.3 – 0.5 µm	10 – 20 µin	0.3 – 0.4 µm	10 – 15 µin
Polished (1 µm diamond)	0.05 – 0.15 µm	2 – 5 µin	0.10 – 0.3 µm	4 – 10 µin
Microhardness	450 HV0.3		250 HV0.3	
Density	6.5 – 6.7 g/cm^3		6.8 – 7.0 g/cm^3	
Porosity	1 – 3 vol. %		1 – 3 vol. %	
Oxide Content	5 – 15 vol. %		2 – 10 vol. %	
Bond Strength	> 27.5 MPa	> 4000 psi	> 27.5 MPa	> 4000 psi
Maximum Service Temperature	760 °C	1400 °F	870 °C	1600 °F

Values shown are typical. Significant variation can be expected depending on spray process, gun and parameers used.

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 442	1000445	5 lb (approx. 2.25 kg)	Stock	Global
Metco 444	1000326	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 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 web site at www.oerlikon.com/metco (Resources – Safety Data Sheets).

Product	SDS No.
Metco 442	50-172
Metco 444	50-174

www.oerlikon.com/metco
info.metco@oerlikon.com