

Material Product Data Sheet

Aluminum Bronze Thermal Spray Powders

Thermal Spray Powder Products: Diamalloy 1004, Metco 51NS, Metco 51F-NS, Metco 445

1 Introduction

Diamalloy™ 1004, Metco™ 51NS, and Metco 51F-NS are golden-colored, inert gas atomized powders. They are bronzes in which aluminum is the main alloying element along with other alloying elements such as iron.

The presence of aluminum in these bronzes helps enhance the corrosion resistance of coatings produced from these materials due to the formation of a thin, tenacious surface oxide that acts as a protective layer to the copper-rich alloy.

Metco 445 is a mechanically clad aluminum bronze that exhibits self-bonding during thermal spray processing as a result of a chemical reaction of the clad components.

Coatings of these materials are easily machined and excellent finishes are achievable. They have good resistance to fretting and galling at low to moderate temperatures, and excellent resistance to abrasion and cavitation. These coatings are recommended for soft bearing applications.

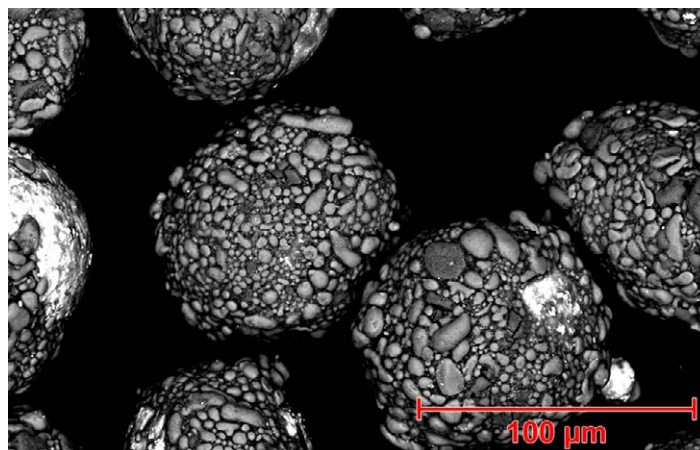
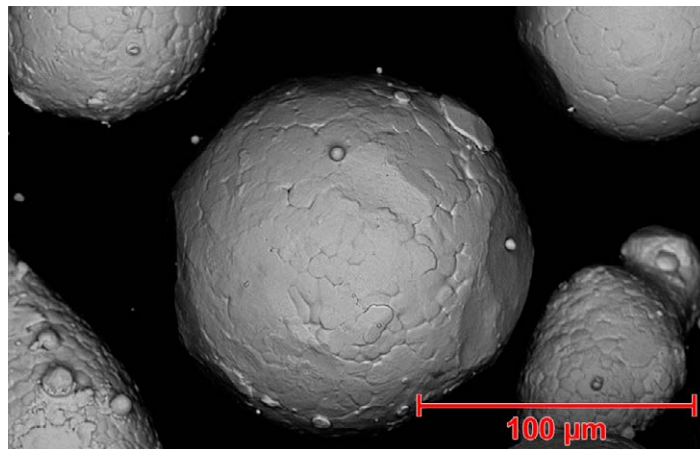
1.1 Typical Uses and Applications

Typical components where coatings of these materials are used include:

- Hydraulic Press Sleeves
- Piston Guides
- Shifter Forks
- Expansion Joints
- Compressor Air Seals
- Pumps
- Water Turbine Nozzles

Quick Facts

Classification	Alloy or composite, copper based
Chemical formula	Cu 9.5Al 1Fe or Cu 10Al
Manufacture	Gas atomized or mechanically clad
Morphology	Spheroidal
Apparent density	3.1 – 4.3 g/cm ³
Flow (Hall)	14 – 25 s / 50 g
Melting point	1040 °C (1900 °F)
Purpose	Corrosion, oxidation and cavitation resistance
Process	HVOF, Atmospheric plasma spray or combustion powder Therospray™



SEM photomicrographs: Top: Metco 51NS (gas atomized), bottom Metco 445 (mechanically clad).

2 Material Information

2.1 Chemical Composition

Product	Weight Percent (nominal)				
	Cu	Al	Fe	Others (max)	Organics (max)
Diamalloy 1004	Balance	8.5 – 10.75	0.5 – 2.0	0.5	---
Metco 51NS	Balance	8.5 – 10.75	0.5 – 2.0	0.5	---
Metco 51F-NS	Balance	8.5 – 10.75	0.5 – 2.0	0.5	---
Metco 445	Balance	7.0 – 12.0	---	---	2.5

2.2 Particle Size Distribution and Other Physical Properties

Product	Particle Size Distribution μm	Morphology	Manufacturing Method	Apparent Density g/cm^3	Flow s/50 g	Similar To
Diamalloy 1004	-53 +5	Spheroidal	Gas Atomized	3.9 – 4.3	15 – 18	UNS C61400
Metco 51NS	-125 +45	Spheroidal	Gas Atomized	3.9 – 4.3	15 – 18	UNS C61400
Metco 51F-NS	-53 +5	Spheroidal	Gas Atomized	3.9 – 4.3	15 – 18	UNS C61400
Metco 445	-106 +45	Spheroidal	Mechanically Clad	3.1 – 3.9	15 – 25	–

Particle size equal to or above 45 μm determined by sieve analysis in accordance with ASTM B214, on U.S. standard sieves to ASTM E11; particle size below 45 μm determined by laser diffraction (Microtrac) per ASTM C 1070.

2.3 Key Selection Criteria

- Choose the product that meets the required customer material specification.
- Choose these materials when better corrosion resistance than that provided by pure copper materials is needed.
- Diamalloy 1004 has a particle size distribution designed for application using HVOF. Metco 51NS, Metco 51F-NS and Metco 445 are designed for application using atmospheric plasma spray or combustion powder Thermospray™.
- The self-bonding nature of Metco 445 can be advantageous in some applications, particularly when applied using combustion powder spray.
- All of these materials are suitable for low temperature applications to produce surfaces where moderate oxidation, wear and cavitation resistance is needed.

2.4 Related Products

- When fretting, wear or cavitation resistance at higher temperatures is needed, copper-nickel materials such as Metco 57NS, Metco 58NS, Amdry 500C or Amdry 500F can be used.
- Choose pure copper materials for inexpensive build-up and restoration of copper-based alloys or when better electrical or thermal conductivity is required. Choose Diamalloy 1007 for HVOF applications and Metco 55 for plasma spray applications.

2.5 Customer Specifications

Product	Customer Specifications
Metco 51NS	GE B50TF161, CI A Rolls-Royce plc 9507/24
Metco 51F-NS	Boeing BMS 10-67, Type II Boeing DMS2049, Type 1 Boeing DSMQPL 2049 Canada Pratt & Whitney CPW 617 CFM International CP 6011 GE B50TF161, CI B Jet Avion JA 13014, CI B Pratt & Whitney PWA 1378-2 Rolls-Royce plc MSRR 9507/29 Snecma DMR 33.092
Metco 445	Honeywell FP 5045, Type XVII Rolls-Royce Corporation EMS 56753 Rolls-Royce Corporation PMI 1363 Rolls-Royce plc MSRR 9507/38

3 Coating Information

3.1 Key Thermal Spray Coating Information

- The information provided in the table is for Metco 51NS applied using a TriplexPro plasma spray gun.
- Metco 51F-NS sprayed using a TriplexPro gun may have a somewhat smoother as-sprayed surface finish and may

be slightly less porous, but apply with a lower deposit efficiency.

- Diamalloy 1004 coatings sprayed using HVOF may be harder and less porous.
- Significant differences can be expected when using different spray guns and processes.

Specification	Metco 51NS		
Spray Gun	TriplexPro-210 (atmospheric plasma spray)		
Deposit Efficiency (approx)	%	71	
Coating Porosity (approx)	vol. %	4	
Macrohardness	As sprayed	HRB	71
Microhardness	As sprayed	HV0.3	158

All reported values are nominal based on standard spray conditions and parameters.

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	HVOF
Metco 9MB series	Metco 5P-II	DiamondJet series
Metco F4 series	Metco 6P-II series	WokaJet series
TriplexPro series		WokaStar series
SimplexPro series		

4 Commercial Information

4.1 Ordering Information and Availability

Product	Order No.	Package Size	Availability	Distribution
Diamalloy 1004	1000783	5 lb (approx. 2.25 kg)	Stock	Global
Metco 51NS	1000330	5 lb (approx. 2.25 kg)	Stock	Global
Metco 51F-NS	1000129	5 lb (approx. 2.25 kg)	Stock	Global
	1000243	25 lb (approx. 11.3 kg)	Stock	Global
Metco 445	1000437	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 to prevent moisture pickup.
- Tumble contents prior to use to prevent segregation.

4.3 Safety Recommendations

See the SDS (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).

Product	SDS No.
Diamalloy 1004	50-116
Metco 51NS	50-116
Metco 51F-NS	50-116
Metco 445	50-175