

Material Product Data Sheet

Bronze Alloy Materials

Powder Products:

Diamalloy™ 1004, Metco™ 51NS, Metco 51F-NS, Metco 445

Wire Products:

Sprabronze™ AA, Sprabronze AB, Sprabronze S, Sprabronze TM

1 Introduction

Diamalloy1004, Metco 51NS, Metco 51F-NS and Metco 445 are aluminum bronze powder products designed for powder-fed thermal spray processes. Sprabronze AA and Sprabronze AB are aluminum bronze wire products for wire feed-stock thermal spray processes. Sprabronze S is a brass alloy wire and Sprabronze TM is a Tobin-type bronze.

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.

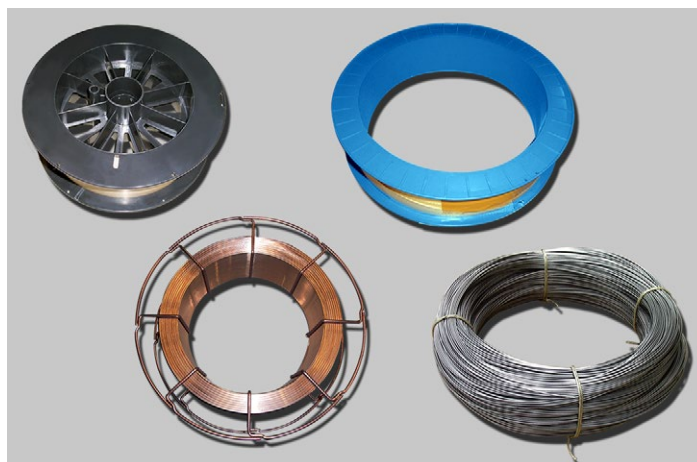
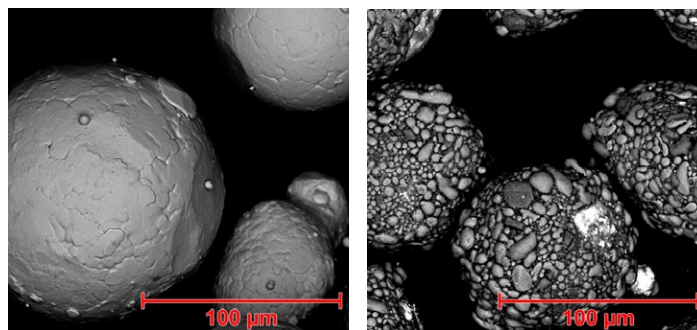
Coatings of these materials are machinable and good to excellent finishes are achievable. They have good resistance to fretting and galling at low to moderate temperatures, and excellent resistance to abrasion and cavitation. Their composition also offers corrosion resistance, especially in mildly oxidizing and neutral atmospheres as well sea water environments. These coatings are recommended for soft bearing applications and machine element repair.

1.1 Typical Uses and Applications

- Diamalloy 1004, Metco 51 series, Metco 445:
 - Hydraulic Press Sleeves
 - Piston Guides
 - Shifter Forks
 - Expansion Joints
 - Compressor Air Seals
 - Pumps
 - Water Turbine Nozzles
- Sprabronze AA, Sprabronze AB and Sprabronze TM:
 - Hard, dense coatings for machine element restoration
 - For use on components such as pump impellers, armature bushings, motor bearings, air brake valves, valve plugs and plungers
- Sprabronze S:
 - Machine element repair
 - Surfaces requiring improved sliding wear resistance.

Quick Facts

Classification	Metal, copper-based	
Chemistry	Various (See Section 2.1)	
Manufacture	Powders:	Gas atomized or mechanically clad
	Wires:	Solid drawn wires
Morphology:	Powders:	Spheroidal
	Wires:	Solid
Apparent density	Powders	3.1 to 4.3 g/cm ³
Max Service Temperature	700 °C (1290 °F)	
Purpose	Corrosion, oxidation and cavitation resistance; machine element repair	
Process	Powders:	HVOF, Atmospheric Plasma Spray or Combustion Powder Thermospray™
	Wires:	Combustion Wire Spray or Electric Arc Wire Spray



Top-left: Typical spheroidal morphology gas atomized powder products. **Top-right:** Mechanically clad Metco 445. **Bottom:** Packaging for wire products..

2 Material Information

2.1 Chemical Composition

Product	Nominal Composition	Chemical Composition (wt. % nominal)						
		Cu	Al	Fe	Sn	Zn	Other (max)	Organic Binder
Powder Products								
Diamalloy 1004	Cu 9.5Al 1.2Fe	Balance	8.5 - 10.75	0.5 to 2.0	---	---	0.5	---
Metco 51NS	Cu 9.5Al 1.2Fe	Balance	8.5 - 10.75	0.5 to 2.0	---	---	0.5	---
Metco 51F-NS	Cu 9.5Al 1.2Fe	Balance	8.5 - 10.75	0.5 to 2.0	---	---	0.5	---
Metco 445	Cu 9.5Al	Balance	7.0 – 12.0	---	---	---	---	2.5
Wire Products								
Sprabronze AA	Cu 9Al 1Fe	Balance	9	1	---	---	0.5	---
Sprabronze AB	Cu 8Al	Balance	8	---	---	---	0.1	---
Sprabronze S	Cu 6Sn	Balance	---	---	6	---	---	----
Sprabronze TM	Cu 40Zn 1Fe 1Sn	Balance	---	1	1	40	0.25	---

2.2 Additional Material Characteristics

2.2.1 Powder Products

Product	Nominal Range (µm)	Apparent Density (g/cm³)	Hall Flow (s/50 g)	Manufacturing Method	Morphology	Similar to
Diamalloy 1004	-53 +5	3.9 - 4.3	15 - 18	Gas Atomized	Spheroidal	UNS C61400
Metco 51NS	-125 +45	3.9 - 4.3	15 - 18	Gas Atomized	Spheroidal	UNS C61400
Metco 51F-NS	-53 +5	3.9 - 4.3	15 - 18	Gas Atomized	Spheroidal	UNS C61400
Metco 445	-106 +45	3.1 - 3.9	15 - 25	Mechanically Clad	Spheroidal	

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..

2.2.1 Wire Products

Product	Available Wire Diameters	Manufacturing Method	Morphology
Sprabronze AA	1.6 mm (0.063 in) 3.2 mm(0.126 in)	Drawn	Solid
Sprabronze AB	3.2 mm(0.126 in)	Drawn	Solid
Sprabronze S	3.2 mm(0.126 in)	Drawn	Solid
Sprabronze TM	3.2 mm(0.126 in)	Drawn	Solid

2.3 Recommended Process

Product	APS	HVOF	CPS	CWS	EAW
Diamalloy 1004		✓			
Metco 51NS	✓		✓		
Metco 51F-NS	✓		✓		
Metco 445	✓		✓		
Sprabronze AA				✓	✓
Sprabronze AB					✓
Sprabronze S					✓
Sprabronze TM				✓	

APS = Atmospheric Plasma Spray, **HVOF** = High Velocity Oxygen Fuel Spray; **CPS** = Combustion Powder Thermospray; **CWS** = Combustion Wire Spray; **EAW** = Electric Arc Wire Spray

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2.4 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.
- Application using powder-fed aluminum-bronze thermal spray products (Diamalloy 1004, Metco 51 series and Metco 445) generally provides higher conductivity than the wire-fed aluminum-bronze products (Sprabronze AA and Sprabronze AB).
- Sprabronze AA produces dense, moderately wear-resistant coatings that have as much as twice the strength and hardness of other bronzes. It is easily machined and produces excellent surface finishes.
- Sprabronze AA and Sprabronze AB offer very good corrosion resistance because the aluminum contained in these material forms a protective oxide surface.
- Sprabronze S is a tin-bronze material. Choose Sprabronze S when a more lubricious copper-based coating is desired on bearing surfaces. It is also a good choice in electrical applications where solderability is required.

- Sprabronze TM is a Tobin-type bronze that can be used in naval brass applications, but tends to be more difficult to machine than Sprabronze AA or Sprabronze AB.
- All of these materials are suitable for low temperature applications to produce surfaces where moderate oxidation, wear and cavitation resistance is needed.

2.5 Related Products

- When thermal management or electrical conductivity is the main concern, consider using a pure copper feed-stock material such as Metco 55, Diamalloy 1007 or Metco Copper. These products are also recommended as an inexpensive buildup and restoration materials for copper-based alloys.
- Coatings of Metco 452 and Metco 453 have better machinability than coatings of Amdry 956 or Metco 450NS.
- If corrosion protection in lye, brine or saltwater at higher temperatures is needed with good bearing properties, consider Metco NiCu.
- Sprababbitt A is a good coating choice for high speed and heavy duty bearing surfaces.
- For a corrosion protective material for use in food processing or when a solderable coating is needed, choose Metco Tin.
- An alternative for improved thermal conductivity, but reduced electrical conductivity is Metco Aluminum.

2.6 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
Sprabronze AA	American Welding Society (AWS) C2.25/C2.25M W-CuAl Rolls-Royce Corporation EMS 50209A Rolls-Royce Corporation PMI 1046 Rolls-Royce plc MSRR 9507/111 MTU MTS 1136 Snecma DMR 33.055

3 Coating Information

3.1 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.

3.2 Recommended Spray Guns

Atmospheric Plasma	Combustion Powder	HVOF	Electric Arc Wire	Bombusion Wire
Metco 3MBM	Metco 5P-II	DiamondJet series	SmartArc PPG	Metco 16E
Metco 9MBM	Metco 6P-II series	WokaJet series	Metco LD/U2	Metco 5K
Metco 11MB		WokaStar series	Metco LD/U3	
Metco F4MB-XL series			Metco LD/Schub 5	
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.	Wire Diameter (if applicable)	Package Size	Package Type	Availability	Distribution
Powders:						
Diamalloy 1004	1000783	---	5 lb (approx. 2.25 kg)	Plastic Jar	Stock	Global
Metco 51NS	1000330	---	5 lb (approx. 2.25 kg)	Plastic Jar	Stock	Global
Metco 51F-NS	1000129	---	5 lb (approx. 2.25 kg)	Plastic Jar	Stock	Global
Metco 445	1000437	---	5 lb (approx. 2.25 kg)	Plastic Jar	Stock	Global
Wires:						
Sprabronze AA	1020399	1.6 mm (0.063 in)	25 lb (11.3 kg)	Dorn Spool	Stock	Global
	1002527	1.6 mm (0.063 in)	15 kg (33 lb)	Wire Basket Reel	Stock	Europe
	1030426	3.2 mm (0.126 in)	25 lb (11.3 kg)	Coil	Stock	Global
	1002504	3.2 mm (0.126 in)	12.5 kg (27.5 lb)	Coil	Stock	Europe
Sprabronze AB	1057795	1.6 mm (0.063 in)	15 kg (33 lb)	Dorn Spool	Stock	Europe
Sprabronze S	1057786	1.6 mm (0.063 in)	13 kg (28 lb)	Hasp Spool	Special Order	Europe
Sprabronze TM	1030512	3.2 mm (0.126 in)	25 lb (11.3 kg)	Coil	Stock	Global

4.2 Handling Recommendations

- Store in the original container in a dry location.
- For powder products, carefully tumble contents prior to use to prevent segregation, but avoid breakdown of friable components for mechanically clad products.
- Open containers of powder should be stored in a drying oven at temperatures to prevent moisture pickup.
- Remove desiccant prior to use, if applicable.

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.
Diamalloy 1004	50-116
Metco 51NS	50-116
Metco 51F-NS	50-116
Metco 445	50-175
Sprabronze AA	50-223
Sprabronze AB	50-1132
Sprabronze S	50-1134
Sprabronze TM	50-239