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Material Product Data Sheet
Pure Molybdenum Powders for Thermal Spray

Thermal Spray Powder Products:
Amdry 313X, Metco 63NS

1 Introduction

Amdry™ 313X and Metco™ 63NS are pure molybdenum powders designed to produce dense, well-bonded coatings applied using atmospheric plasma spray.

Coatings of molybdenum provide good frictional properties and scuff resistance as a result of an adherent, oxide surface layer that forms rapidly after spraying. The coatings are also hard and lubricious in nature, offering excellent dry-running properties. They are, therefore, often used in applications to resist fretting and sliding wear.

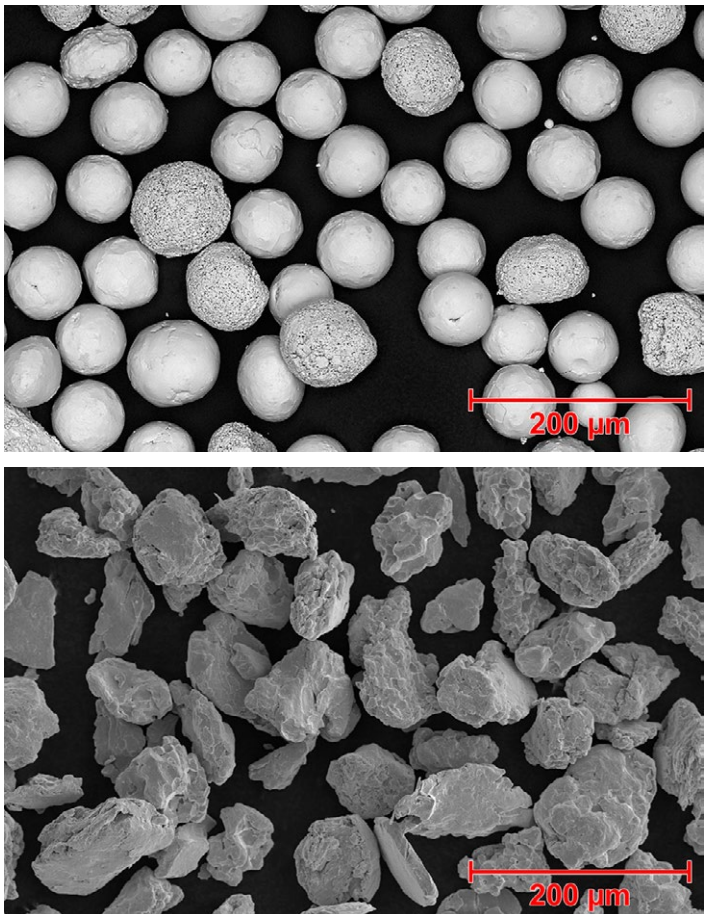
Coatings of these materials can be used at service temperatures up to 340 °C (650 °F). Coatings should not be used at higher service temperatures, as the molybdenum can oxidize rapidly.

Properly applied, Amdry 313X and Metco 63NS are self-bonding to steel substrates. They can be used on magnesium alloy or aluminum alloy substrates with proper precoat surface preparation to eliminate substrate surface oxides. Molybdenum coatings are not compatible with copper or copper alloy substrates.

1.1 Typical Uses and Applications

- Automotive components such as piston rings and synchronizing rings
- Diesel engine fuel injectors
- Continuous casting and ingot molds
- Glass manufacturing components such as melting electrodes and furnace components
- Lathe bedways
- Valve and pump components
- Gears
- Cam followers
- Pins and connectors subject to fretting or sliding wear
- Resistance to molten metals when used in non-oxidizing atmospheres

Quick Facts	
Classification	Pure metal, molybdenum-based
Chemical formula	Mo 99.0 %+
Manufacture	Various (see Section 2.3)
Morphology	Spheroidal or irregular
Apparent density	5.8 – 5.9 g/cm^3
Melting point	2620 °C (4748 °F)
Service temperature	340 °C (650 °F)
Purpose	Wear and scuff resistance
Process	Atmospheric plasma spray



SEM photomicrographs: Top: Amdry 313X (agglomerated and densified); bottom Metco 63NS (sintered and crushed).

2 Material Information

2.1 Chemical Composition

Product	Weight Percent (nominal)	
	Mo	Others (max)
Amdry 313X	Balance	0.5
Metco 63NS	Balance	0.5

2.2 Particle Size Distribution and Flow

Product	Nominal Particle Size Distribution µm	Sieve Analysis (% max)			Flow s/50 g
		+90 µm	+75 µm	–45 µm	
Amdry 313X	–75 +45	1	15	20	10
Metco 63NS	–75 +25	0.5	10	20	18

Particle sizes 45 µm and above analyzed via sieve analysis in accordance with ASTM B214; particle sizes below 45 µm analyzed via laser diffraction (Microtrac).

2.3 Other Physical Properties

Product	Manufacturing Method	Morphology	Nominal Apparent Density (g/cm^3)
Amdry 313X	Agglomerated and Densified	Spheroidal	5.8
Metco 63NS	Sintered and Crushed	Irregular	5.9

2.4 Key Selection Criteria

- Choose the material that meets the OEM specifications required, if applicable.
- Consider Amdry 313X for new coating applications. In general, it is a lower cost material but coating results and deposit efficiencies are similar to those obtainable using Metco 63NS. However, coating hardness using Amdry 313X may be slightly lower.

2.5 Related Products

- Tribaloy-type materials offer an excellent combination of corrosion, oxidation and wear resistance at service temperatures up to 760 °C (1400 °F). Coatings of these materials can be used in applications where lubrication is low or non-existent; however, they do not offer the lubricity that coatings of pure molybdenum offer. Materials for application using atmospheric plasma spray or HVOF are available.
- Amdry 1371 and Metco 7837 are powder blends of molybdenum and a self-fusing nickel-chromium material. These materials produce coatings with high wear resistance, good scuff resistance and low frictional characteristics. They can be used at service temperatures similar to Amdry 313X and Metco 63NS.
- For sliding wear resistance in corrosive environments, a chromium oxide coating can be considered. These coatings produce surfaces that are chemically inert in most acid, alkaline and alcohol environments. While generally not as tough as coatings of molybdenum, varying amounts of titanium oxide do help to improve their toughness. They can also be used at somewhat higher service temperatures of up to 540 °C (1000 °F).
- Coatings of tungsten carbide with cobalt matrixes can provide improved resistance to other types of wear conditions, such as environments where particle erosion is an issue, or where a hard, fret- or gall-resistant material is needed at higher temperatures up to 500 °C (930 °F). These coatings are generally best when applied using HVOF spray. They do not offer chemical resistance or the lubricious surface properties of molybdenum materials. They do have excellent impact resistance, particularly with higher percentages of cobalt matrixes.

2.6 Customer Specifications

Product Name	Customer Specifications
Amdry 313X	Avio 4800M/30
	Canada Pratt & Whitney CPW 213
	CFM International CP 6019
	GKN Aerospace PM 819-13
	Pratt & Whitney 1313
	Rolls-Royce Corp. EMS 56705
	Rolls-Royce Corp. PMI 1252
	Rolls-Royce plc MSRR 9507/19
	Rolls-Royce plc RRMS 40006
Metco 63NS	Avio 4800M/30
	Canada Pratt & Whitney CPW 213
	CFM International CP 6019
	Chromalloy BZ-003, Type 1
	GKN Aerospace PM 819-13
	Honeywell EMS 57738
	Honeywell M3953
	MTU MTS 1054
	Pratt & Whitney 1313
	Rolls-Royce plc MSRR 9507/19
	Rolls-Royce plc RRMS 40006
	Snecma DMR 33.0017
	U. S. Military A-A 59315/9
	U. S. Military MIL-P-83348 Type 1, Comp A, Cl. 2
	U. S. Military USAF 67A80753

3 Coating Information

3.1 Key Thermal Spray Coating Information

Specification			
Recommended Spray Process	Atmospheric Plasma Spray		
Deposit Efficiency (approx)	70 % – 80 %		
Porosity	< 4 vol. %		
Macrohardness	69 – 74 HR15N		
Microhardness	420 – 455 HV0.3		
Recommended Finishing Method	Wet Grind using SiC Wheel		
Service Temperature Max	340 °C	650 °F	

- The information provided in the table is for Amdry 313X and Metco 63NS.
- Significant differences can be expected when using different spray guns and processes.

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 Atmospheric Plasma Spray Guns
F4MB-XL series
9MBM
TriplexPro series
SinplexPro series

4 Commercial Information

4.1 Ordering Information and Availability

Product	Order No.	Package Size	Availability	Distribution
Amdry 313X	1001037	5 lb (approx. 2.25 kg)	Stock	Global
Metco 63NS	1000058	5 lb (approx. 2.25 kg)	Stock	Global

Note: When purchased from an Oerlikon Metco facility in Germany, an authorized German export license (BAFA) is required.

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 SDS 50-125 (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).

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