Material Product Data Sheet
Cobalt Alloy — Hexagonal Boron Nitride Powder

Thermal Spray Powder Products: Amdry 958

1 Introduction

Cobalt-based Amdry™ 958 thermal spray powder has been designed to create thermal spray coatings that protect against metal-to-metal wear of frictionally engaged, titanium alloy parts resulting from fretting, adhesion and galling. Coatings of Amdry 958 are advantageous when only one surface of the friction couple can be coated because of space restrictions, such as in a dovetail attachment of a compressor blade to a disc.

The powder is a cermet blend consisting of a CoCrAlYSi alloy and hexagonal boron nitride (hBN). High strength coatings with low hBN content applied using the HVOF process or lower strength coatings with high hBN content applied using atmospheric plasma spray can be tailored to suit specific application requirements. Amdry 958 coatings were tested up to 450 °C (840 °F), outperforming CuNiIn coatings in all critical criteria such as coefficient of friction, disc wear and deepest disc pit.

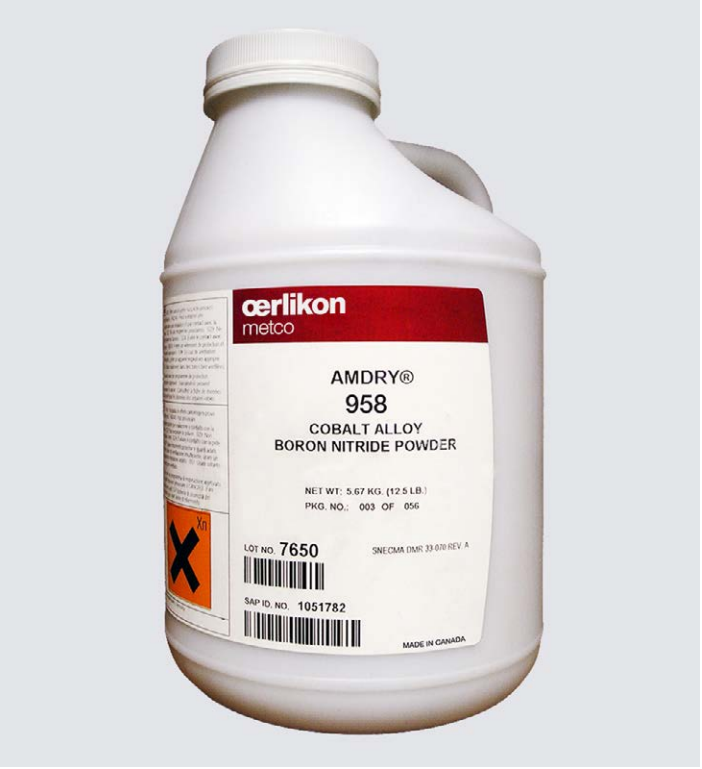
Coatings of Amdry 958 exhibit high compressive strength and can be used on compressor blades of all sizes, including large blades in the fan and low pressure compressor sections. Each specific application should be tested by the potential user under conditions similar to actual service conditions.

1.1 Typical Uses and Applications

Amdry 958 was developed for fan and compressor sections of aircraft engines for these uses:

- Coated fan blade roots vs. unprotected titanium alloy disc slots
- Coated compressor blade roots vs. unprotected titanium alloy discs
- Coatings protect against fretting, adhesion and galling damage of titanium alloy discs
- Tested for service temperatures up to 450 °C (840 °F)

Quick Facts	
Classification	Cermet, cobalt based
Chemistry	CoCrAlYSi – hBN
Manufacture	Blended
Morphology	Spheroidal / Irregular
Purpose	Wear protection (fretting, adhesion and galling)
Apparent Density	2.06 g/cm^3
Maximum Service Temperature	450 °C (840 °F)
Process	HVOF or Atmospheric Plasma Spray



2 Material Information

2.1 Chemical Composition

	Weight Percent (nominal)					
	Co	Cr	Al	Y	Si	hBN
Amdry 958	Balance	25	5	0.27	1.75	15

2.2 Particle Size Distribution and Manufacturing Method

	Nominal Range µm	Manufacturing Method
Amdry 958	–177 +10	Blend

Particle size analysis of hBN component and upper range of CoCrAlYSi component using sieve in accordance with ASTM B214; lower size analysis of CoCrAlYSi components using laser diffraction (Microtrac).

2.3 Key Selection Criteria

Coatings of Amdry 958 were designed to rub against unprotected titanium alloy surfaces in those situations where only one surface of the friction couple can be coated because of space restrictions.

2.4 Related Products

Extensive fretting tests on production-sprayed Amdry 958 and Metco 58NS CuNiIn samples indicate that coatings of Amdry 958 exhibit superior behavior compared to CuNiIn coatings.

During initial fretting, some Amdry 958 is transferred to the uncoated surface, thus minimizing any damage to titanium alloy surfaces by creating a condition where the Amdry 958 coating is rubbing against itself. The titanium alloy surface protected by the transferred material experiences a slight increase in thickness of approximately 12.5 µm (0.0005 in) rather than wear.

Metco 58NS CuNiIn coatings tested under identical conditions resulted in substantial wear of the titanium alloy surface. The same trends were observed in titanium scratching (pitting) evaluations. Metco 58NS coatings caused titanium alloy scratches (pits) on the titanium alloy surface that were several times deeper compared to coatings of Amdry 958. These advantages of Amdry 958 over Metco 58NS were demonstrated throughout the entire service temperature range of CuNiIn up to 315 °C (600 °F). Similar results would apply for Amdry 500F and Amdry 500C,

Coatings of Amdry 958 have a coefficient of friction that are 30 % to 60 % lower than coatings of Metco 58NS, Amdry 500F or Amdry 500C in the temperature range of 21 °C to 315 °C (70 °F to 600 °F).

Amdry 958 coatings exhibit higher compressive strength and can withstand extreme pressures compared to copper-based coatings such as Metco 58NS, Amdry 500F or Amdry 500C. This makes Amdry 958 useful in applications with large blades in the fan and low pressure compressor sections of the turbine engine.

2.5 Customer Specifications

Product	Customer Specification
Amdry 958	CFM International CP 6041 Snecma DMR 33.070

3 Coating Information

3.1 Thermal Spray Process Information

Two significantly different classes of Amdry 958 coatings can be created, depending on which spray process is used to apply the coating:

- Coatings applied using the HVOF spray process have a lower hBN content, which results in coatings of higher hardness and bond strength.
- Coatings applied using the atmospheric plasma spray process (APS) contain larger amounts of hBN, resulting in a softer coating with lower bond strength.

Unless the user knows precisely the coating requirements for a specific application, it is recommended that both classes of coatings be tested under conditions that simulate actual service conditions.

3.2 Key Thermal Spray Coating Information

Specification	Typical Data			
	HVOF		Atmospheric Plasma Spray	
Substrate Preparation	dry grit blast		dry grit blast	
Bond Coat	not required		not required	
Coating Thickness	100 – 150 µm	0.004 – 0.006 in	100 – 150 µm	0.004 – 0.006 in
Thickness per Pass	3 µm	0.0001 in	10 µm	0.0004 in
Maximum Thickness [a]	800 µm	0.031 in	750 µm	0.029 in
Coating Color	grey with white specks of hBN		grey with white specks of hBN	
Microstructure Characteristics	low retained hBN content, dense, some unmelted particles		high retained hBN content, higher porosity	
Bond Strength	41 – 55 MPa	6000 – 8000 psi	24 – 35 MPa	3500 – 5100 psi
Microhardness (HV300)	300 – 330		150 – 270	
Porosity + hBN + Oxides (vol. %)	< 10		40 – 50	
Coefficient of Friction (Fretting)	0.36 – 0.40		0.36 – 0.40	
Coating Density	7.8 g/cm^3		6.0 g/cm^3	
Coating Weight	0.78 kg/m^2/0.1 mm	0.040 lb/ft^2/0.001 in	0.60 kg/m^2/0.1 mm	0.031 lb/ft^2/0.001 in
Finishing	as-sprayed		as-sprayed	
As-Sprayed Surface Roughness (Ra)	4.5 – 6.5 µm	175 – 250 µin	6.0 – 9.0 µm	235 – 350 µin
Maximum Service Temperature [b]	450 °C	840 °F	450 °C	840 °F

[a] Thickness limits per testing performed and / or verified by Oerlikon Metco
[b] Only short exposures at these temperatures have been tested

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 Spray Guns	
HVOF	Atmospheric Plasma Spray
DiamondJet™ (air-cooled)	TriplexPro™ series *
	Metco 9MB series
	Metco F4 series

* Applies both standard plasma coatings and high velocity plasma coatings similar to HVOF coatings.

4 Commercial Information

4.1 Ordering Information and Availability

	Order No.	Package Size	Availability	Distribution
Amdry 958	1091813	10 lb (approx. 4.5 kg)	Stock	Global

4.2 Handling Recommendations

- Store in the original container in a dry location.
- Tumble contents manually for 15 seconds prior to use to prevent segregation.
- Powder in open containers should be stored in a drying oven at temperatures below 38 °C (100 °F) to prevent moisture pick-up while avoiding oxidation.

4.3 Safety Recommendations

See SDS 50-909 (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).

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