

# Material Product Data Sheet

## Chromium Carbide – Nickel Chromium Composite Powder

### Thermal Spray Powder Products: Diamalloy 3007

#### 1 Introduction

Diamalloy™ 3007 is a chemically clad composite with each chromium carbide particle completely encapsulated in a nickel chromium shell.

The metal cladding minimizes decarburization and oxidation of the chromium carbide during the spray process and permits a more efficient deposition of the chromium carbide that contributes to exceptional wear resistance of the coating.

Chromium carbide Diamalloy powders are characterized by their ability to provide wear, oxidation and hot corrosion resistance at elevated temperatures. The addition of NiCr cladding improves corrosion properties. Higher NiCr content results in increased fracture toughness of the coatings.

Diamalloy 3007 coatings are extremely dense. Coatings made exhibit exceptionally high bond strength of greater than 90 MPa (13,000 psi), indicating a superb combination of coating adhesion and cohesion.

#### 1.1 Typical Uses and Applications

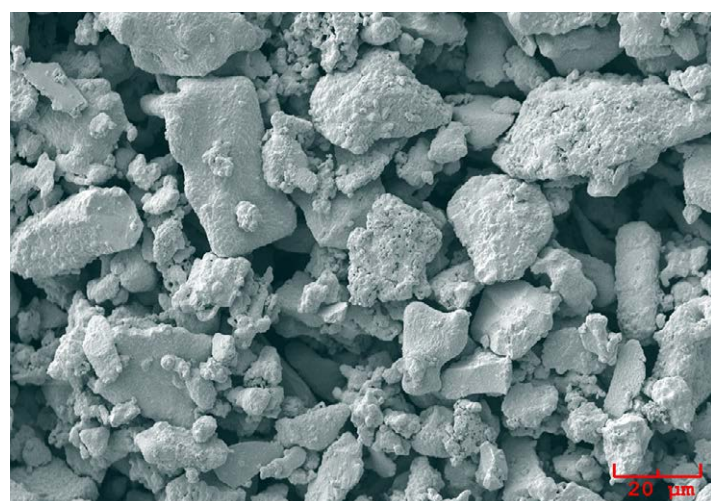
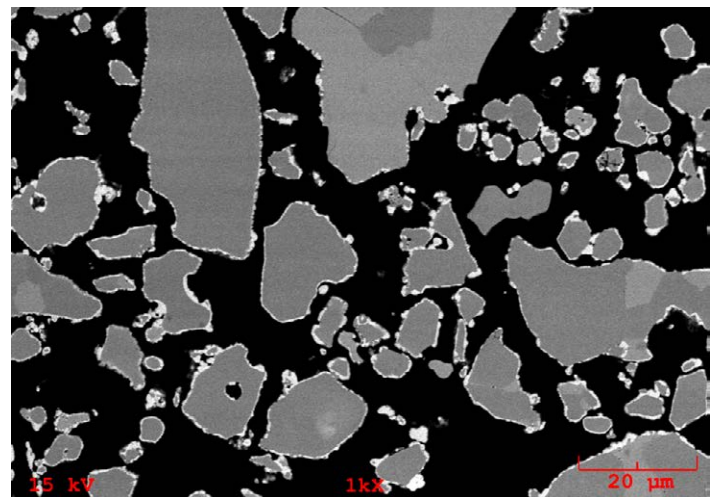
- Recommended for severe abrasive and erosive wear applications where tungsten carbide cannot be used at temperatures up to 870 °C (1600 °F).
- Diamalloy 3007 is used in industry for its fretting wear properties at elevated temperatures.
- Best performance of the coating is achieved using the HVOF spray process.

#### Typical Components:

- Fuel rod mandrels
- Hot crushing rolls
- Forging tools
- Turbine exhaust struts and exhaust flaps
- Hot forming dies
- Turbine air seal rings
- Turbine air seal spacers
- Turbine inner nozzle supports, stages 1 through 4
- Knife edge seals
- Pump seals and liners
- Circulating fluidized bed combustors
- Valve stems
- Turbine baffle dampers

#### Quick Facts

Classification	Cermet, chromium carbide based
Chemistry	Cr <sub>3</sub> C <sub>2</sub> – NiCr
Manufacture	Chemically clad
Morphology	Irregular
Apparent Density	2.3 g/cm <sup>3</sup> nominal
Service Temperature	≤ 870 °C (1600 °F)
Purpose	Wear resistance
Process	HVOF



Diamalloy 3007. Top: SEM Cross-section photomicrograph. Bottom: SEM morphology.

## 1.1 Typical Uses and Applications (continued)

### Markets:

- Turbomachinery
- Petrochemical
- Alternative to hard chrome plating

## 2 Material Information

### 2.1 Chemical Composition, Color and Apparent Density

Product	Phase Composition (wt %)		NiCr Composition (wt %)		Color	Apparent Density (g/cm <sup>3</sup> )
	Cr <sub>3</sub> C <sub>2</sub>	NiCr	Ni	Cr		
Diamalloy 3007	80	20	80	20	Gray	2.3

All reported values are nominal

### 2.2 Particle Size Distribution

Product	Nominal Range $\mu\text{m}$	Microtrac Analysis		
		D90	D50	D10
Diamalloy 3007	-45 +5.5	42 – 63	22 – 32	10 – 15

Particle size for upper size range using sieve analysis; lower size range analysis using laser diffraction (Microtrac).

### 2.3 Key Selection Criteria

- The low NiCr content and high coating hardness of Diamalloy 3007 makes it a good choice for anti-fretting applications and for use in applications to replace hard chrome plating.
- Diamalloy 3007 coatings exhibit high macrohardness and microhardness with very low porosity and very high bond strength. These characteristics, combined with an exceptionally fine as-sprayed surface makes Diamalloy 3007 a premium product.
- Diamalloy 3007 may be used for many applications with no subsequent grinding as a result of its fine as-sprayed surface.
- Use Metco 82VF-NS or Amdry 367 when a chromium carbide with a very low percentage of binder is preferred.
- Use Metco 70C-NS or Metco 70F-NS for applications that require pure chromium carbide coatings.
- When atmospheric plasma spray is preferred, chromium carbide powders to choose from include Amdry 367, Metco 70C-NS, Metco 81NS, Metco 81VF-NS, Metco 82VF-NS, Metco 430NS, Metco 5265, and Metco 5546NS.
- Metco 430NS can be sprayed using the combustion powder Thermospray™ process.
- Metco 5241 can be used for hard chrome replacement when higher deposition efficiencies are required. Coatings of this material exhibit excellent erosion and oxidation properties with superior superfinished surfaces.
- Woka 7100 series [Cr<sub>3</sub>C<sub>2</sub>-20(Ni 20Cr)] and Woka 7200 series [Cr<sub>3</sub>C<sub>2</sub>-25(Ni 20Cr)] products can be used when agglomerated and sintered materials are preferred. These materials are available in many particle size distributions appropriate for a variety of HVOF spray guns.

### 2.5 Customer Specifications

Product	Customer Specification
Diamalloy 3007	GE B50A845, CI B Honeywell EMS 52544 Sec 1.3 Type IV Pratt & Whitney PWA 36332-1S Rolls-Royce plc MSRR 9507/71 Williams CWIMS 794

## 3 Coating Information

### 3.1 Key Thermal Spray Coating Characteristics

Specification <sup>a</sup>		Diamalloy 3007 <sup>(1)</sup>	
Recommended Process		High Velocity Oxy-Fuel (HVOF)	
Recommended Bond Coat		Not required	
Bond Strength <sup>b</sup>		> 90 MPa	> 13000 psi
Deposit Efficiency	approx.	30 – 45 %	
Porosity		< 1 vol. %	
Surface Roughness	as-sprayed machined	2.5 – 4 µm < 0.25 µm	100 – 170 µin < 10 µin
Post Finishing Technique		Use as-sprayed or grind	
Macrohardness	approx.	92 – 93 HR15N	65 – 68 HRC <sup>c</sup>
Microhardness		800 – 1150 HV0.3	
Thickness Limitation <sup>d</sup>		> 0.63 mm	> 0.025 in
Service Temperature	max	870 °C	1600 °F

<sup>a</sup> Properties reported for Diamalloy 3007 based on coatings applied using a variety of spray guns as listed in Section 3.3.

<sup>b</sup> In all cases, the tensile strength of the coatings exceeded the strength of the glue. Absolute tensile strengths are unknown.

<sup>c</sup> Converted

<sup>d</sup> Coating thickness limitations will depend on the application hardware and parameters used.

### 3.2 Recommended Coating Finishing

Specification	Setting	
Grinding	Silicon carbide	
Wheel Speed	25 – 30 m/s	5000 – 6000 ft/min
Condition	Water flood coolant with 2% rust inhibitor	

Note: The use of diamond grinding also produces an excellent finish.

### 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 HVOF Spray Guns

WokaJet™ series guns

Diamond Jet™ 2700

Diamond Jet™ air-cooled guns

Praxair Tafa JP-5000

## 4 Commercial Information

### 4.1 Ordering Information and Availability

Product	Order No.	Package Size	Availability	Distribution
Diamalloy 3007	1000796	5 lb (approx. 2.25 kg)	Stock	Global

### 4.2 Handling Recommendations

- Store in the original container in a dry location.
- Tumble contents prior to use to prevent segregation.
- Open containers should be stored in a drying oven at a temperature that prevents moisture pickup.

### 4.3 Safety Recommendations

See SDS 50-510 (Safety Data Sheet) localized for the country where the material will be used. SDS are available from the Oerlikon web site at [www.oerlikon.com/metco](http://www.oerlikon.com/metco) (Resources – Safety Data Sheets).

Information is subject to change without prior notice.