

## Material Product Data Sheet

### Nickel Chromium Cobalt Titanium Molybdenum Tungsten Aluminum Superalloy Powder (Similar to René 80)

#### Thermal Spray Powder Products: Diamalloy 4004NS

##### 1 Introduction

Diamalloy™ 4004NS (René 80) is a nickel-based superalloy powder that is similar in composition to René 80. Diamalloy 4004NS combines excellent oxidation, erosive wear and hot gas corrosion resistance at higher temperatures. Its corrosion resistance is the result of its high chromium content.

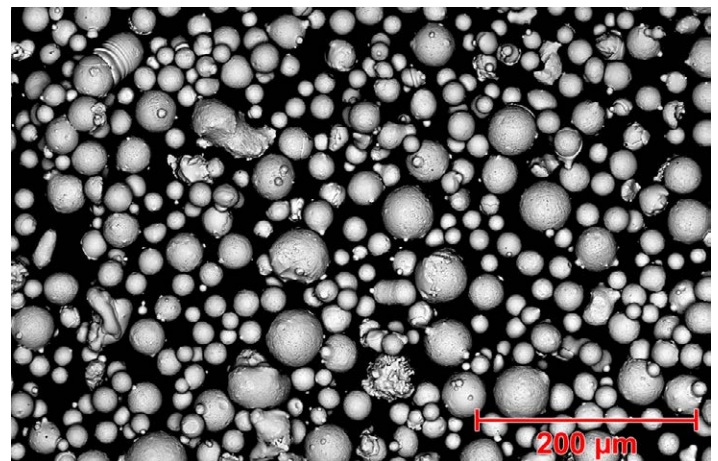
This inert gas atomized powder has a fine particle size distribution tailored for HVOF applications. Coatings produced using Diamalloy 4004NS exhibit superior service temperature capabilities in addition to their inherent resistance to corrosion and erosion.

##### 1.1 Typical Uses and Applications

- Surface restoration and repair of various worn, damaged, mis-machined superalloy components used at high service temperatures
- Typically used on gas turbine components, chemical processing equipment and rocket engine components

#### Quick Facts

|                     |  |
|---------------------|--|
| Classification      | Superalloy, nickel-based   |
| Chemistry           | Ni 14Cr 9.5Co 5Ti 4Mo 4 W 3Al                                    |
| Manufacture         | Gas atomized   |
| Morphology          | Spheroidal   |
| Apparent Density    | 3.9 – 4.4 g/cm <sup>3</sup>                                      |
| Service Temperature | ≤ 1000 °C (1830 °F)  |
| Purpose             | Restoration, high temperature oxidation and corrosion resistance |
| Process             | HVOF   |



SEM Photomicrograph of Diamalloy 4004NS showing the morphology of this gas atomized powder product

## 2 Material Information

### 2.1 Chemical Composition

| Product          | Nominal Chemical Composition (wt. %) |      |     |     |     |     |     |      |       |
|------------------|--------------------------------------|------|-----|-----|-----|-----|-----|------|-------|
|                  | Ni                                   | Cr   | Co  | Ti  | Mo  | W   | Al  | Zr   | B     |
| Diamalloy 4004NS | Bal.                                 | 14.0 | 9.5 | 5.0 | 4.0 | 4.0 | 3.0 | 0.03 | 0.015 |

### 2.2 Particle Size Distribution and Other Properties

| Product          | Nominal Particle Size Distribution (µm) | Manufacturing Method | Morphology | Apparent Density (g/cm <sup>3</sup> ) | Similar To |
|------------------|---|----------------------|------------|---------------------------------------|------------|
| Diamalloy 4004NS | -45 +11                                 | Gas Atomized         | Spheroidal | 3.0 – 4.4                             | René 80    |

Upper particle size via sieve analysis in accordance with ASTM B214; lower particle size analysis via laser diffraction (Microtrac).

### 2.3 Key Selection Criteria

- Diamalloy 4004NS produces coatings that exhibit superior oxidation, hot corrosion and erosive wear resistance at high temperatures.
- Diamalloy 4004NS coatings are oxidation and corrosion resistant at temperatures up to 1000 °C (1830 °F).

### 2.4 Related Products

- For coatings with excellent oxidation and corrosion resistance at high temperatures, but somewhat limited wear resistance, choose an alloy with a chemistry similar to an Inconel alloy such as Amdry 713C, Amdry 718 Cl. B, Amdry 1718, Diamalloy 1005, or Diamalloy 1006 (see Datasheet DSMTS-0085).
- An alternative choice for lower temperature salvage applications may be coating materials with chemistries similar to Hastelloy, such as Diamalloy 4276 (see datasheet DSMTS-0086).
- NiCrAlY materials like Amdry 961 and Amdry 962X series products are widely used in aerospace applications.

They require a post coat diffusion heat treatment to optimize the coating properties. These coatings are effective in oxidizing environments at high temperatures, but relatively mild hot corrosion resistance compared to CoNiCrAlY and NiCoCrAlY materials. They are also not as hard or wear resistant as coatings of Diamalloy 4004NS (see Datasheet DSMTS-0103).

- CoNiCrAlY powders such as Amdry 995 series, Diamalloy 4454, Diamalloy 4700 and Metco 4451 produce coatings that can be used at a slightly higher service temperatures and are better suited for hot corrosion environments compared to the NiCrAlY products. In addition to these CoNiCrAlY materials, Oerlikon Metco also offers a number of NiCoCrAlY products. The benefit of both these families are chemistries that produce coatings with a balanced combination of high temperature oxidation resistance and hot corrosion resistance. Again, hardness and wear are not as good as Diamalloy 4004NS or Inconel-type materials (See datasheets DSMTS-0092 and DSMTS-0093)

### 2.5 Customer Specifications

| Product          | Customer Specifications |
|------------------|-------------------------|
| Diamalloy 4004NS | GE B50TF183, CI C       |

## 3 Coating Information

### 3.1 Key Thermal Spray Coating Information

| Specification               | Typical Data                        |
|-----------------------------|-------------------------------------|
| Recommended Spray Process   | High Velocity Oxy-Fuel Spray (HVOF) |
| Maximum Service Temperature | 1000 °C<br>1830 °F                  |

Data provided is typical and variability can be expected. Changes in spray process, spray equipment or spray parameters can significantly change coating results.

### 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 HVOF Spray Guns

DiamondJet series

WokaJet series

WokaStar series

## 4 Commercial Information

### 4.1 Ordering Information and Availability

| Product          | Order No. | Package Size           | Availability  | Distribution |
|------------------|-----------|------------------------|---------------|--------------|
| Diamalloy 4004NS | 1001611   | 10 lb (approx. 4.5 kg) | Special Order | Global       |

### 4.2 Handling Recommendations

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

### 4.3 Safety Recommendations

See SDS 50-775 (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](http://www.oerlikon.com/metco) (Resources – Safety Data Sheets).

Rene is a registered trademark of Teledyne Industries, Inc.  
Hastelloy is a registered trademarks of Haynes International Inc. Corporation  
Inconel is a registered trademark of Huntington Alloys Corporation

Information is subject to change without prior notice.