

# Material Product Data Sheet

## Calcia-Stabilized Zirconium Oxide Thermal Spray Powders

### Thermal Spray Powder Products: Metco 201NS, Metco 201B-NS, Metco 201B-NS-1

#### 1 Introduction

Metco™ 201NS, Metco 201B-NS and Metco 201B-NS-1 are calcia (lime) stabilized zirconium oxide (ZrO<sub>2</sub> 5CaO) powders suitable for thermal spraying. They are designed to produce thermal barrier coatings with fairly porous, “soft” structures to provide thermal insulation, thermal shock resistance, and resistance to hot corrosion and sulfidation in high-temperature, combustion environments.

Calcium partially stabilizes the zirconia, which helps to reduce phase transformations as the coating passes through critical temperature regions. This results in coatings that are less prone to volumetric changes.

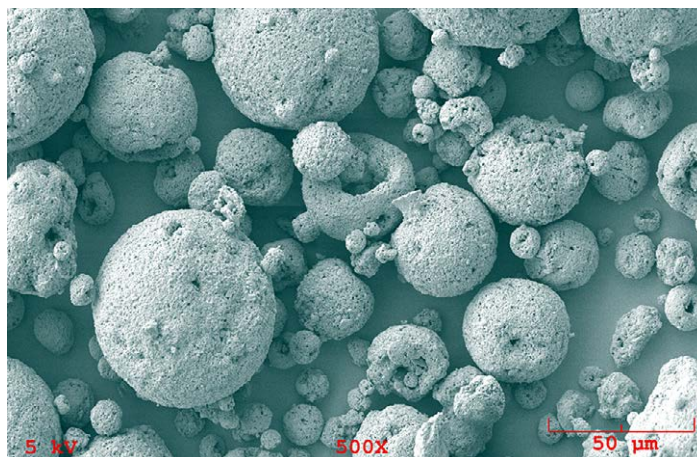
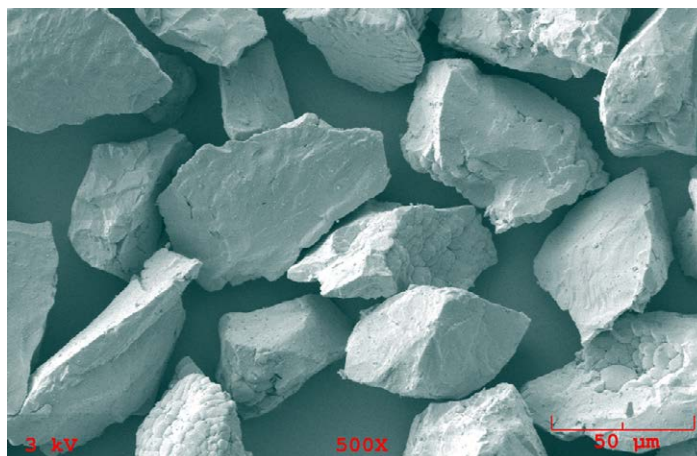
Metco 201NS and Metco 201B-NS are fused and crushed materials, which gives the particles high strength and hardness, while Metco 201B-NS-1 is an agglomerated material with spheroidally shaped particles that have excellent flow during spraying.

#### 1.1 Typical Uses and Applications

- Thermal barrier coatings used in rocket and turbine engine combustion chambers and other hot section components.
- Lining for special purpose crucibles to prevent contamination of the molten contents.
- Resistance to erosion at temperatures above 845 °C (1550 °F) for rocket nozzles and missile nose cones.
- Abrasive wear resistant coatings for diesel engine pistons, valves, cylinder heads and coatings for casting molds and troughs up to approximately 900 °C (1650 °F). Coatings resist wetting and the corrosive effects of molten metal.

#### Quick Facts

Classification	Oxide ceramic, zirconia based
Chemistry	ZrO <sub>2</sub> 5CaO 0.5Al <sub>2</sub> O <sub>3</sub> 0.4SiO <sub>2</sub>
Manufacture	Fused and crushed or agglomerated
Morphology	Angular and blocky or spheroidal
Service temperature	≤ 900 °C (1650 °F)
Melting point	2565 °C (4650 °F)
Purpose	Thermal protection
Process	Atmospheric Plasma Spray or ChamPro™ (LVPS, LPPS, VPS)



Photomicrographs: Fused and Crushed (top), Agglomerated (bottom).

## 2 Material Information

### 2.1 Chemical Composition and Phase Constituents

Product	Chemical Composition (wt. %)		
	ZrO <sub>2</sub> <sup>a</sup> (min)	CaO <sup>b</sup>	Other Oxides
Metco 201NS	91.5	4.5–5.5	Bal.
Metco 201B-NS	91.5	4.5–5.5	Bal.
Metco 201B-NS-1	91.5	4.5–5.5	Bal.

<sup>a</sup>Including a maximum of 2.5% HfO<sub>3</sub>, counted as ZrO<sub>2</sub>.

<sup>b</sup>For Metco 201B-NS-1, the CaO is present in the composite powder as CaCO<sub>3</sub> (8.3 – 8.9%).

### 2.2 Particle Size Distribution

Note: other particle size distributions are available on request

Product	Nominal Range (µm)	Screen Analysis (%)	
		+45 µm	-45 µm
Metco 201NS	-53 +11	7.0 max	–
Metco 201B-NS	-75 +30	–	25 max
Metco 201B-NS-1	-90 +25	–	35 – 65

Screen analysis per ASTM Standard B214

Note: Other particle size distributions are available on request

### 2.3 Other Properties

Product	Apparent Density (g/cm <sup>3</sup> )	Manufacture	Morphology
Metco 201NS	2.3 ± 0.25	Fused and Crushed	Angular / Blocky
Metco 201B-NS	2.4 ± 0.25	Fused and Crushed	Angular / Blocky
Metco 201B-NS-1	1.6 ± 0.25	Agglomerated	Spheroidal

### 2.4 Key Selection Criteria

- Choose the product that meets the required customer material specifications.
- Metco 201NS and 201B-NS are designed for thermal barrier coatings in hot corrosive combustion environments.
- Metco 201B-NS-1 can be sprayed thicker and coatings are more erosion-resistant than coatings of Metco 201NS.

### 2.5 Related Products

- Metco 204 series (HOSP™, agglomerated and plasma-densified), Metco 22XX and Metco 23XX series (agglomerated and sintered) products are 7 – 8 wt.% yttria-stabilized zirconia materials. These powders are

spheroidal with excellent flow and high deposit efficiency during the coating process. Also, coatings of these materials can be used at higher service temperatures than the Metco 201 series of materials.

- Metco 201 series coatings have fairly good abrasion resistance, although less than coatings of Metco 101 (grey alumina) and Metco 105 (white alumina).
- Coatings of Metco 143 are more resistant to erosion and scuffing, and are harder than coatings produced using the Metco 201 family of materials.

Please refer to the data sheets of the related products for further information.

## 2.6 Customer Specifications

Product	Customer Specification
Metco 201NS	GKN Aerospace PM 819-26 (except Sec. 2.4 and 2.6) Honeywell FP 5045, Type XIV Rolls-Royce Corporation EMS 56720 Rolls-Royce plc MSRR 9507/18
Metco 201B-NS	Canada Pratt & Whitney CPW 212 MTU MTS 1067 Pratt & Whitney PWA 1312 U. S. Military Naval OS10604, Type II
Metco 201B-NS-1	Snecma DMR 33.089

## 3 Coating Information

### 3.1 Key Thermal Spray Coating Information

Characteristic	Typical Data
Recommended coating processes	APS (Atmospheric Plasma Spray) or ChamPro™ (Controlled Atmosphere Plasma Spray)
Recommended bond coat	Suitable high-temperature materials that are compatible with the substrate. NiAl, NiCr or MCrAlY bond-coats are recommended.
Typical porosity range	5 – 10 %
Thermal conductivity	0.9 – 1.4 W/mK
Thermal expansion	10 µm/m °C 5.6 µin/in °F
Service temperature	
Erosion resistance	> 845 °C 1550 °F
Abrasion resistance	≤ 900 °C 1650 °F
Post finishing	Typically used as-sprayed. May be SiC or diamond ground
Microstructure characteristics	Homogeneously porous

### 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 spray guns

Atmospheric Plasma	ChamPro
Metco 9MB series	Metco O3CP
Metco SM F-100 Connex	
Metco 11MB	
Metco 3MB series	
Metco F4MB-XL series	
TriplexPro series	

## 4 Commercial Information

### 4.1 Ordering Information and Availability

Product	Order No.	Package Size	Availability	Distribution
Metco 201NS	1000055	12.5 lb (approx. 5.7 kg)	Stock	Global
Metco 201B-NS	1000064	12.5 lb (approx. 5.7 kg)	Stock	Global
	1000059	5 lb (approx. 2.25 kg)	Stock	Global
Metco 201B-NS-1	1004621	5 lb (approx. 2.25 kg)	Special Order	Global

### 4.2 Handling Recommendations

- Store in the original container in a dry location.
- Carefully tumble contents prior to use to prevent segregation, but avoid breakdown of friable components.
- Open containers should be stored in a drying oven at temperatures to prevent moisture pickup.

### 4.3 Safety Recommendations

See SDS 50-145 (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).