

# Material Product Data Sheet

## Premium EBC-Grade Aluminum Silicate (Mullite) Powder

### Thermal Spray Powder Products: Metco 6150

#### 1 Introduction

Metco™ 6150 is a fused and crushed aluminum silicate (mullite) material developed specifically for application using plasma spray as part of an Environmental Barrier Coating (EBC) system. Such EBCs are used to protect Ceramic Matrix Composites (CMCs) at service temperatures up to 1300 °C (2370 °F). The CMCs used for aerospace applications are generally lightweight, silicon-based materials of SiC and Si<sub>3</sub>N<sub>4</sub>).

The key design requirements for mullite powders used for these applications are a low thermal expansion coefficients compared to traditional YSZ thermal barrier materials, low thermal conductivity and high phase stability throughout the coating service life and operating temperatures. Typically, the mullite is applied over a bond coat of silicon or a silicon-based cermet.

In addition, to prevent water vapor penetration to the base material, which could attack silica-based oxide scales and undermine the EBC system, an additional top coat can be applied of rare earth silicates such as barium strontium aluminosilicate (BSAS) or a blend of BSAS and mullite that extends operating life and service temperatures .

Amorphous phases can form during the deposition of mullite that cause premature cyclic failure. Thus, the EBC is often heat treated prior to placement into service to optimize the coating. These heat treatment cycles and conditions are generally proprietary to the OEM.

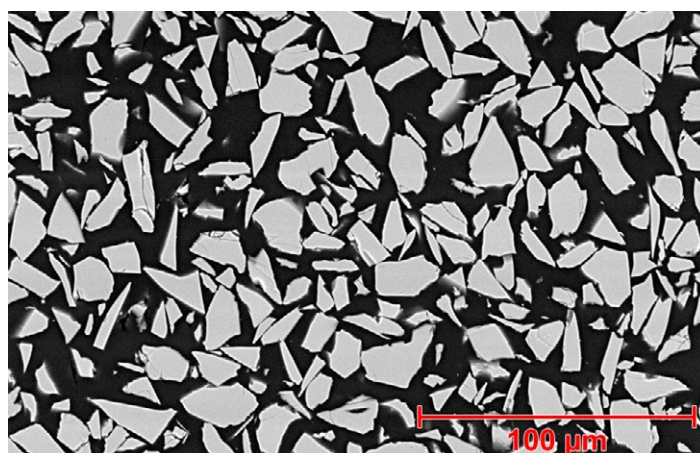
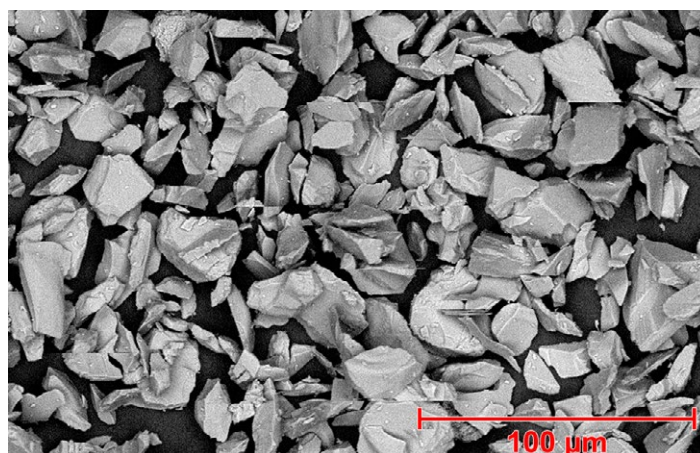
#### 1.1 Typical Uses and Applications:

Mullite powder is used for:

- EBC top-coat material on turbine blades and vanes
- EBC top-coat material on turbine combustor components
- Wear coating with a low coefficient of expansion

#### Quick Facts

Classification	Ceramic, aluminum silicate
Chemistry	3Al <sub>2</sub> O <sub>3</sub> 2SiO <sub>2</sub>
Manufacture	Fused and Crushed
Morphology	Irregular
Thermal Expan. Coef.	5 – 6 10 <sup>-6</sup> /°C (2.8 – 3.3 10 <sup>-6</sup> /°F)
Thermal Conductivity	2.5 – 3.5 W/mK
Service Temperature	≤ 1300 °C (2370 °F)
Purpose	Thermal and environmental insulation
Process	Atmospheric Plasma Spray



SEM Photomicrographs showing powder morphology (top) and microstructure (bottom).

## 2 Material Information

### 2.1 Chemical Composition

Product	Weight Percent (nominal)		
	Al <sub>2</sub> O <sub>3</sub>	SiO <sub>2</sub>	Other Oxides
Metco 6150	Balance	23 – 28	1 max

### 2.2 Additional Powder Characteristics

	Nominal Range (µm)	D90 (µm)	D50 (µm)	D10 (µm)
Metco 6150	-45 +5	35 – 40	20 – 25	10 – 15

Size analysis using laser diffraction (Microtrac)

### 2.3 Key Selection Criteria

- Choose Metco 6150 as a functioning layer in an EBC coatings system and/or when the following surface properties are required:
  - Excellent high temperature properties
  - Excellent thermal shock resistance
  - Excellent thermal stability
  - Resistant to most chemical attack mechanisms — excellent stability against acidic slags and insoluble in most acidic media
  - Excellent abrasion resistance
  - Low thermal expansion coefficient
- Metco 6150 can be applied using atmospheric plasma spray with high deposition rates

### 2.4 Related Products

- For better wear resistance and higher coating hardness, aluminum oxide materials can be used. For better dielectric properties a high purity aluminum oxide can be used.
- For better high temperature corrosive wear, resistance, a chromium oxide material can be chosen.
- Low expansion materials (silicon based) such as Metco 4810 or Metco 4811 should be used as a bond coat for Metco 6150.

## 3 Coating Information

### 3.1 Key Thermal Spray Coating Information

Specification	Typical Data	
Recommended Spray Process	Atmospheric Plasma Spray	
Thermal Expansion Coefficient	5 – 6 x 10 <sup>-6</sup> °C <sup>-1</sup>	2.7 – 3.3 x 10 <sup>-6</sup> °F <sup>-1</sup>
Thermal Conductivity	2.2 – 2.8 W/m·K depending on coating microstructure	
Maximum Service Temperature	1300 °C	2370 °F

Data is 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 Spray Guns

Metco F4 series

Metco 9MB series

TriplexPro series

SinplexPro series

## 4 Commercial Information

### 4.1 Ordering Information and Availability

Product	Order No.	Package Size	Availability	Distribution
Metco 6150	1087504	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 to prevent moisture pickup.

### 4.3 Safety Recommendations

See SDS 50-1502 (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).