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metco

Material Product Data Sheet
Ytterbium Silicate Powders for Thermal Spray

Thermal Spray Powder Products: Metco 6157, Metco 6160

1 Introduction

Metco™ 6157 ytterbium disilicate ($Yb_2Si_2O_7$) and Metco 6160 ytterbium monosilicate (Yb_2SiO_5) are agglomerated and sintered materials developed specifically for application using the atmospheric plasma spray process. Plasma sprayed coatings of Metco 6157 and Metco 6160 are greater than 98% dense and are typically used as part of an Environmental Barrier Coating (EBC) system at service temperatures up to 1350 °C (2460 °F) over a silicon or silicon-based bond coat.

Environmental Barrier Coatings are used to protect Ceramic Matrix Composites (CMCs) that are typically constructed from lightweight, silicon-based materials. Key design requirements of EBCs include dense coating microstructures, low recession rate in steam environments, high melting temperature, excellent phase stability and resistance to calcium-magnesium-alumina-silicate (CMAS) attack.

The usual bond coat materials for EBCs are silicon or silicon-based cermets.

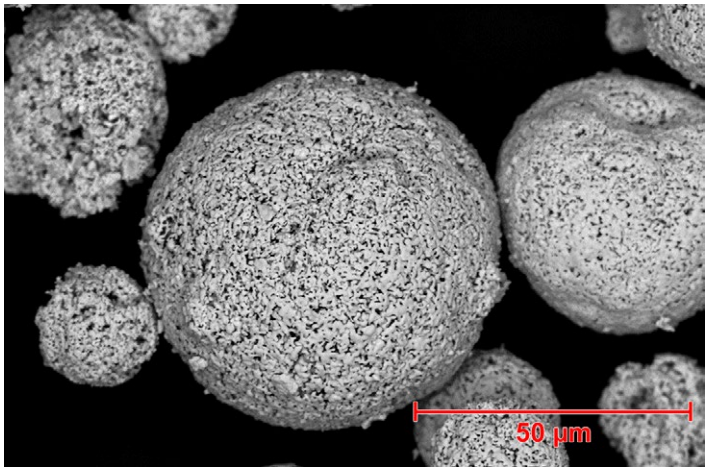
Metco 6157 produces layers that have a matched Coefficient of Thermal Expansion (CTE) with CMCs and is thermochemically compatible with the thermally grown oxide (TGO). Because of this, it should be used as an intermediate layer to reduce stresses caused by CTE mismatch and to further prevent penetration of water vapor to the substrate.

Compared to Metco 6157, Metco 6160 is more resistant to steam as well as CMAS attack. Therefore, it can be used as a top coat to prevent environmental attack and further improve the service life of EBC coating systems.

Since thermal spraying rare earth silicate materials can cause the formation of amorphous phases that can result in premature cyclic failures, it is important to optimize the post-coat heat treatment of EBC coating systems before subjecting the coating to service environments. Frequently, heat treatment cycles and processes are proprietary to the turbine engine OEM.

Quick Facts	
Classification	Ceramic, ytterbium oxide-based
Chemistry	Metco 6157: $Yb_2Si_2O_7$ Metco 6160: Yb_2SiO_5
Manufacture	Agglomerated and sintered
Morphology	Spherical
Service Temperature [a]	≤ 1350 °C (2460 °F)
Purpose	Thermal insulation / environmental isolation
Thermal Expansion Coefficient	4.5 – 5.0 10^{-6}/°C
Thermal Conductivity	1.8 – 2.0 W/m·K
Process	Atmospheric plasma spray

[a] Dependent on engine service conditions



1.1 Typical Uses and Applications:

- Airfoils
- Combustor Liners
- Blade Tracks / Shrouds
- Exhaust Components

2 Material Information

2.1 Chemical Composition

Product	Nominal Composition (wt. %)				
	Yb_2O_3	SiO_2	Al_2O_3	Na_2O	Other Oxides
Metco 6157	Balance	23	< 0.1	< 0.1	0.5 max
Metco 6160	Balance	13	< 0.1	< 0.1	0.5 max

2.2 Particle Size Distribution

Product	Nominal Range (µm)	D90 (µm)	D50 (µm)	D10 (µm)
Metco 6157	-90 +11	60 – 80	30 – 45	15 – 25
Metco 6160	-90 +11	60 – 80	30 – 45	15 – 25

Upper particle size analysis via sieve, lower particle size analysis via laser diffraction (Microtrac)

2.3 Key Selection Criteria

- Choose the product that meets the specific customer's coating property requirements.
- Coating layers of Metco 6157 and Metco 6160 exhibit excellent high-temperature service properties and excellent thermal stability.
- Metco 6160 has improved resistance to water vapor and CMAS attack and can be used as a functional top layer in an EBC system.
- Metco 6157 has a matched CTE with CMC substrates and is thermochemically compatible with the TGO layer. It should be used as an intermediate layer to reduce stresses caused by CTE mismatch and to further prevent water vapor penetration to the bond coat and substrate.

2.4 Related Products

- Metco 4810 is recommended as a potential bond coat material
- For an enhanced diffusion barrier layer, Metco 6150 is recommended.

3 Coating Information

3.1 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 Spray	Controlled Atmosphere Plasma Spray (LPPS, LVPS, VPS)
Metco 9MB series	SinplexPro 03C
Metco F4MB-XL series	
SinplexPro series	
TriplexPro series	

4 Commercial Information

4.1 Ordering Information and Availability

Product	Order No.	Package Size	Availability	Distribution
Metco 6157	1089564	5 lb (approx. 2.26 kg)	Special Order	Global
Metco 6160	2359210	5 lb (approx. 2.26 kg)	Special Order	Global

4.2 Handling Recommendations

- Store in the original container in a ventilated location approved for flammable liquids.
- Keep container tightly closed and sealed until ready for use.
- Containers that have been opened must be carefully re-sealed and kept upright to prevent leakage.
- Container must be rolled or shaken to fully re-suspend sediments prior to opening.

4.3 Safety Recommendations

See the product SDS (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).

Product	SDS Index No.
Metco 6157	50-1859
Metco 6160	50-2916

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