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Material Product Data Sheet
Yttrium Oxide Thermal Spray Powder

Powder Products:
Metco™ 6035A, Metco 6035A-1, Metco 6015

1 Introduction

Yttrium oxide is a highly stable compound with a high melting point and is very inert chemically. Yttrium oxide is also known to possess excellent plasma-etch and erosion resistance, particularly in plasmas containing halogen species. In addition, yttrium oxide exhibits excellent electrical insulation (volume resistivity and dielectric breakdown strength).

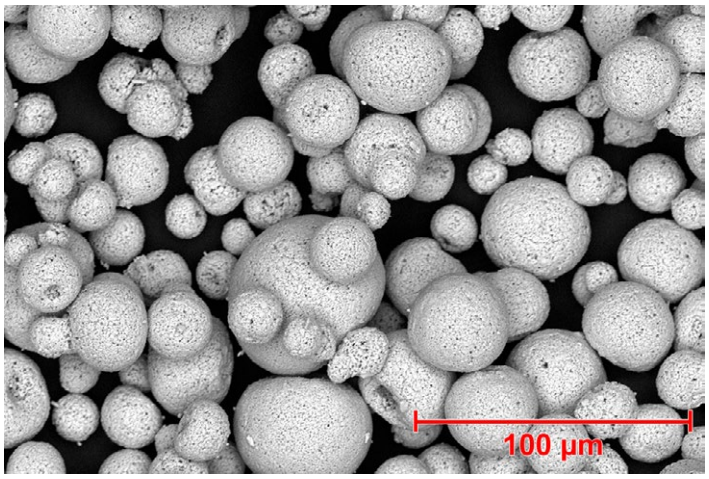
Yttria coatings used on chamber walls and tooling for semiconductor manucturing, which are typically applied by atmospheric plasma spray, must be of high purity, highly resistant to etching and erosion, and generate minimal particulates. This requires coatings with high density, hardness and homogeneity. Oerlikon Metco's yttrium oxide powders have a smoothly-surfaced, spherical morphology and a tightly controlled particle size distribution. Superior flow and injection characteristics during plasma spraying allows complete melting of the powder particles resulting in a dense, uniform and smooth coating formation with high electrical insulation and corrosion resistant properties.

Yttrium oxide coatings are also stable at high temperatures and resistant to many reactive molten metals. For these reasons, coatings of yttrium oxide are are suitable for plasma-exposed surfaces in semiconductor device manufacturing systems as well as a number of other applications.

1.1 Typical Uses and Applications

- Plasma etch and erosion resistance on surfaces exposed to reactive plasma gases in semiconductor manufacturing systems, such as vacuum chamber walls and other components
- Electrostatic chucks
- Linings for graphite molds

Quick Facts	
Classification	Ceramic, yttria
Chemistry	Y_2O_3
Manufacture	Agglomerated or agglomerated and sintered
Morphology	Spheroidal
Apparent Density	1.4 to 1.1 g/cm^3 (typical)
Service Temperature	≤ 2000 °C (3630 °F), lower in reducing environments
Melting Point	2425 °C (4397 °F)
Purpose	Plasma etching / erosion resistance, electrical insulation, thermal / chemical resistance
Process	Atmospheric Plasma Spray



2 Material Information

2.1 Chemical Composition (typical analysis)

Product	Y_2O_3	Fe	Na	Mg	Al	Si	K	Ca	Organics
	wt. % min.								wt.%
Metco 6035A	99.95	5	3	3	10	10	10	10	–
Metco 6035A-1	99.9	10	10	10	10	25	10	25	–
Metco 6015	96.0	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	

N.R. = Not reported

2.2 Particle Size Distribution and Other Physical Characteristics

Product	Nominal Particle Size Range (µm)	Color	Typical Apparent Density (g/cm³)	Manufacturing Method	Phase Composition
Metco 6035A	–53 +15	White	1.4	Agglomerated & Sintered	Cubic Yttria
Metco 6035A-1	–53 +15	White	1.1	Agglomerated & Sintered	Cubic Yttria
Metco 6015	–106 +16	White	1.1	Agglomerated	Cubic Yttria

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

2.3 Key Selection Criteria

- Metco 6035A is a premium product. With its very low levels of trace impurities and its suitable electrical, thermal, mechanical and chemical properties, Metco 6035A produces coatings that provide superior performance when applied to surfaces exposed to reactive plasma for systems used for manufacturing semiconductor devices.
- Coatings of Metco 6035A-1 and Metco 6015 also resist erosion from reactive plasma. However, because of the presence of relatively higher levels of trace impurities, they are more suitable for other applications such as mold linings exposed to reactive molten metals, molds used in sintering furnaces to fixture parts, etc., which are less sensitive to minor impurity elements and where thermal stability and chemical resistance are of primary importance.

2.4 Related Products

- Oerlikon Metco's high purity alumina product, Metco 6103, is more suitable for applications where electrical breakdown strength, thermal conductivity and mechanical properties (hardness, fracture toughness, etc.) are more important than plasma etch and erosion resistance. In some cases a multilayer structure combining both Metco 6103 and Metco 6035A (or Metco 6035A-1) may provide the best results.
- Oerlikon Metco also offers a wide range of metal and metallic thermal spray powders that can be used as bond coats for ceramic coatings. Please search our Thermal Spray Materials Guide or ask your Oerlikon Metco sales representative assistance.

3 Coating Information

3.1 Key Thermal Spray Coating Information

Specification	Typical Data for Metco 6035A and Metco 6035A-1	
Recommended Process	Atmospheric Plasma Spray	
Deposition Efficiency	43 % – 45 %	
Surface Profile As Sprayed (Ra)	3.8 – 5.1 µm	150 – 200 µin
Macrohardness	92 HR15T	
Dielectric Strength @ 25 °C	16 – 20 kV/mm	410 – 500 V/mil
Volume Resistivity @ 25 °C	$> 10^{12}$ Ω·cm	

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 Atmospheric Plasma Spray Guns
Metco F4 series
SinplexPro series
TriplexPro series

4 Commercial Information

4.1 Ordering Information and Availability

Product	Order No.	Package Size	Availability	Distribution
Metco 6035A	1088319	2 kg (approx. 4.4 lb)	Stock	Global
Metco 6035A-1	1088320	2 kg (approx. 4.4 lb)	Stock	Global
Metco 6015	1002383	5 lb (approx. 2.2 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 the correct SDS (Safety Data Sheet) for the product of interest localized for 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 No.
Metco 6035A	50-1179
Metco 6035A-1	50-1179
Metco 6015	50-546

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