

Material Product Data Sheet

Pure Titanium Oxide Powders

Powder Products:

Metco™ 6231A, Metco 6232B, Metco 6233C, Metco 6233D, Metco 102, Amdry™ 6505, Amdry 6510

1 Introduction

Titanium oxide coatings are used for a wide variety of applications that include wear resistant coatings, electrically conductive coatings, dry lubricious coatings and decorative coatings.

Low electrical resistivity and favorable sputtering properties allow their use as sputter targets to deposit thin films of titania on architectural and automotive glass. The electrical properties of the coatings are strongly influenced by the stoichiometry (x-factor) of the powder.

Metco 623XX series powders are spheroidal, agglomerated and sintered materials ideal for sputter targets. As a result of their highly controlled x-factors, coatings with controlled electrical resistance can be produced. In addition, coatings with relatively higher porosity can be obtained with Metco 623XX powders, therefore they can produce thick coatings without cracking or delamination. In fact, Metco 623XX powders can produce controlled dense or porous structures with minor adjustments to spray parameters.

The spheroidal powders have excellent flow and exhibit significantly better deposit efficiencies, even at high feed rates. Therefore, Metco 623XX series powders produce excellent coatings, yet are economical to apply.

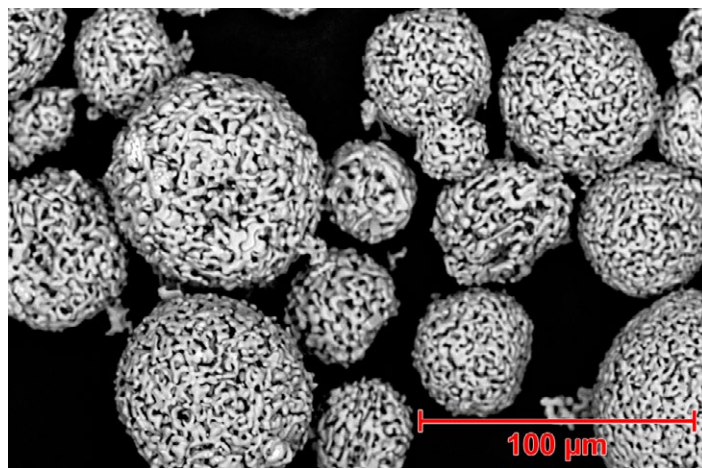
Fine grade agglomerated and sintered spheroidal powder can be used for non-thermal spray processes such as press and sinter to produce filter elements and membranes.

1.1 Typical Uses and Applications

- Electrically conductive coatings for sputter targets for use in thin film processes to produce thin titania films on architectural and automotive glass
- Sliding wear resistance for automotive applications such as cylinder bore liners
- Oxygen sensors
- Decorative coatings having a dark gray color
- Mandrels for the production of dry cell batteries
- Biomedical implants
- Filter elements and membranes

Quick Facts

Classification	Oxide ceramic, titania based
Chemistry	TiO ₂ 99.0 +
Manufacture	Fused and crushed or agglomerated and sintered
Morphology	Angular, blocky or spheroidal
Purpose	Wear and corrosion resistance, decorative, electrical conductance
Melting Point	1843 °C (3350 °F)
Service Temperature	≤ 540 °C (1000 °F)
Process	Atmospheric plasma spray, combustion powder Thermospray™, or press and sinter



SEM Photomicrographs. Top: Metco 102 (fused and crushed). Bottom: Metco 6231A (agglomerated and sintered).

2 Material Information

2.1 Chemical Composition

	Chemical Composition (wt. %)					
	TiO ₂	Al ₂ O ₃	Fe ₂ O ₃	SiO ₂	All Others	x-factor
Metco 6231A	Balance	< 0.1	< 0.1	< 0.1	< 0.5	1.7
Metco 6232B	Balance	< 0.1	< 0.1	< 0.1	< 0.5	1.8
Metco 6233C	Balance	< 0.1	< 0.1	< 0.1	< 0.5	1.9
Metco 6233D	Balance	< 0.2	< 0.1	< 0.2	< 0.5 ^a	1.9
Metco 102	Balance	< 0.1	< 0.1	< 0.1	< 0.5	1.9
Amdry 6505	Balance	< 0.2	< 0.2	< 0.2	< 0.5	1.9
Amdry 6510	Balance	< 0.1	< 0.1	< 0.2	< 0.5	1.9

^a Indicates the total of all remaining oxides which includes Al₂O₃, Fe₂O₃, SiO₂ and other trace oxides

2.2 Particle Size Distribution and Other Characteristics

	Nominal Particle Size Distribution	Color	Morphology	Manufacturing Method
Metco 6231A	-105 +32 µm	Dark Grey to Black	Spheroidal	Agglomerated and Sintered
Metco 6232B	-150 +45 µm	Dark Grey to Black	Spheroidal	Agglomerated and Sintered
Metco 6233C	-150 +38 µm	Dark Grey to Black	Spheroidal	Agglomerated and Sintered
Metco 6233D	-30 +10 µm	Dark Grey to Black	Spheroidal	Agglomerated and Sintered
Metco 102	-45 +11 µm	Dark Grey	Angular / Blocky	Fused and Crushed
Amdry 6505	-45 +5 µm	Dark Grey	Angular / Blocky	Fused and Crushed
Amdry 6510	-106 +38 µm	Dark Grey	Angular / Blocky	Fused and Crushed

Particle size of 45 µm and above determined by sieve analysis, lower particle sizes below 45 µm determined by laser diffraction (Microtrac).

2.3 Key Selection Criteria

- Metco 102, Amdry 6505 and Amdry 6510 are fused and crushed products that are similar in chemistry, manufacturing process and morphology. They differ, however, in particle size distribution, which will have an affect on the density and as-sprayed surface finish of the coating. In general, finer cuts result in denser, smoother coatings.
- Metco 623XX series materials are agglomerated and sintered products with a spheroidal morphology that feed well during spraying. These powders are designed to produce coatings with low electrical resistivities and potentially superior tribological properties. Also, the unique microstructure of the powders significantly improves deposit efficiencies, even at high feed rates, reducing processing time and overall waste.
- For wear and corrosion resistance, harder and denser coatings are preferred. For applications requiring thick coatings, some level of porosity must be present in the coating. When using fused and crushed powders, choose finer materials for dense coatings and coarser materials for thicker coatings. When using Metco 623XX products, however, the porosity can be controlled to achieve dense, hard coatings or more porous, thick coatings with relatively minor spray parameter adjustments.
- Metco 6233D is a fine grade, agglomerated and sintered powder that is designed for non-thermal spray processes, such as press and sinter, to achieve a specific porosity within the final coating.

2.4 Related Products

■ Oerlikon Metco's product portfolio includes a number of materials that combine titania with either chromia or alumina. The addition of chromia or alumina to titania increases hardness and wear resistance of the coating. For example:

- Coatings of products that combine chromia and titania feature increased hardness, wear resistance and corrosion resistance as a result of the addition of chromia compared to coatings or pure titania. These products include Metco 111 (TiO₂-45CrO₃) and Metco 6482 (Cr₂O₃-40TiO₂).
- Coatings of products that combine alumina and titania feature increased hardness and wear resistance in proportion to the amount of alumina in the materials, but coating toughness decreases as titania is reduced. These products include Amdry 6240, Amdry 6244, Amdry 6250, Amdry 6254, Amdry 6257 and Metco 131VF (all Al₂O₃ – 40TiO₂), Amdry 6220, Amdry 6224, Amdry 6228, Metco 130, Metco 130SF

(all Al₂O₃ – 13TiO₂), Metco 101SF, Amdry 6200, Metco 6203, Metco 101NS, Amdry 6204, Metco 101B-NS, Amdry 187, Amdry 6208 (all Al₂O₃– 3TiO₂).

- Coatings of pure chromia materials or chromia materials that contain very small amounts of titania can be used for applications requiring high wear and chemical resistance. Pure chromia coatings can withstand higher service temperatures compared to pure titania coatings. These products include Amdry 6415, Amdry 6420, Metco 6156, Metco 106NS, Metco 106, Metco 106F and XPT-D-062.
- Coatings of pure alumina can be used in many applications that require abrasive, sliding or erosive wear resistance such as wear pads, seal rings and liners. These products include Amdry 6060, Amdry 6062, Metco 105NS, Metco 105SFP, and Metco 6100. Materials of high purity alumina (e.g. Metco 105SFP and Metco 6100) are suitable for electrical, thermal and biomedical applications such as high tension and high temperature insulators, electronic substrates, and medical implants.

3 Coating Information

3.1 Key Thermal Spray Coating Information

Specification	Typical Data
Recommended Spray Process ^a	Atmospheric Plasma Spray or Combustion Powder Thermospray™
Maximum Service Temperature ^b	540 °C 1000 °F
Finishing Method	Wet grind (silicon carbide wheels)

^a Atmospheric plasma spray will produce denser coatings that can be ground to smoother finishes than coatings produced using combustion powder spray.

^b Do not use these coatings at higher temperatures to avoid potential cracking as a result of phase transformation.

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 Thermal Spray Guns

Combustion Powder	Atmospheric Plasma
Metco 6P-II series	Metco 9MB series
Metco 5P-II	Metco F4 series
	TriplexPro series
	SinplexPro series

4 Commercial Information

4.1 Ordering Information and Availability

	Order No.	Package Size	Availability	Distribution
Metco 6231A	1075736	3 kg (approx. 6.5 lb)	Stock	Global
Metco 6232B	1075738	3 kg (approx. 6.5 lb)	Stock	Global
Metco 6233C	1075740	3 kg (approx. 6.5 lb)	Stock	Global
Metco 6233D	1096927	3 kg (approx. 6.5 lb)	Stock	Global
Metco 102	1000328	12.5 lb (approx. 5.7 kg)	Stock	Global
Amdry 6505	1005562	10 kg (approx. 22 lb)	Stock	Europe
Amdry 6510	1002834	10 kg (approx. 22 lb)	Stock	Europe

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 the 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 6231A	50-1482
Metco 6232B	50-1482
Metco 6233C	50-1482
Metco 6233D	50-1482
Metco 102	50-136
Amdry 6505	50-136
Amdry 6510	50-136

Information is subject to change without prior notice.