

Material Product Data Sheet

Pure Titanium Oxide Powders

Powder Products:
Metco™ 102, Amdry™ 6505, Amdry 6510,
Amdry 6151

1 Introduction

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

Coatings of these materials are resistant to abrasion and sliding wear. They are also corrosion resistant and can be used in harsh chemical environments.

Overall, coatings of pure titanium oxide exhibit very good toughness for a ceramic material. Further, finer cuts can produce relatively dense coatings with good as-sprayed surface finishes. Due to the relatively low melting point of titania fine powders can also be successfully sprayed with HVOF processes to produce extremely dense coatings. For many purposes APS is still more feasible both economically and performance-wise. Titania coatings are typically dark grey to black in color due to the substoichiometry of the material.

Substoichiometric TiO_x ($x < 2$) is electrically conductive. This allows its use as sputter targets to deposit thin films of titania on architectural and automotive glass.

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 / black color
- Mandrels for the production of dry cell batteries
- Biomedical implants
- Filter elements and membranes
- Coatings for titanium or nickel based superalloy components in highly corrosive environments, such as process industry valves

Quick Facts

Classification	Oxide ceramic, titania based
Chemistry	TiO_2 99.0 +
Manufacture	Fused and crushed
Morphology	Angular, blocky
Purpose	Wear and corrosion resistance, decorative, electrical conductance
Melting Point	1843 °C (3350 °F)
Service Temperature	≤ 540 °C (1000 °F)
Process	Atmospheric plasma spray, HVOF-GF, Combustion powder Thermospray™



SEM Photomicrograph of Metco 102 showing typical fused and crushed morphology of these materials.

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 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
Amdry 6515	Balance	< 0.1	< 0.1	< 0.2	< 0.5	1.9 (+/- 0.02)

^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 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
Amdry 6515	-70 +30 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 Recommended Spray Process

	Atmospheric Plasma Spray	Combustion Powder Thermospray™	HVOF-GF
Metco 102	✓	✓	✓
Amdry 6505	✓	✓	✓
Amdry 6510	✓	✗	✗
Amdry 6515	✓	✗	✗

2.4 Key Selection Criteria

- Metco 102, Amdry 6505, Amdry 6510 and Amdry 6515 are similar in chemistry, manufacturing process and morphology. Particle size can be selected according to spray system and requirement for coating density.
- Although all of these powders are substoichiometric, and produce electrically conductive coatings, Amdry 6515 has a tightly controlled x-factor of 1.90 +/- 0.02 specifically for sputter target applications.
- For wear and corrosion resistance, harder and denser coatings are preferred. Therefore finer cuts sprayed with APS or even HVOF should be used. For applications requiring thick coatings, some level of porosity helps to control stresses in the coating. Choose finer materials for dense, thinner coatings and coarser materials for thicker coatings.

2.5 Related Products

- Titania is widely used with aluminum oxide and chrome oxide as an alloying oxide to improve toughness of pure alumina and chromia. As an electrically conductive oxide, substoichiometric titania also affects the electrical properties when used as an alloying or blended oxide.
- Oerlikon Metco's Alumina-titania powders can be found on datasheets DSM-0258, DSM-0236 and DSM-0393
- Oerlikon Metco has also chromia-titania materials
- Metco111 (TiO₂-45Cr₂O₃) for added wear resistance DSM-0382
- Metco 6485 Cr₂O₃-25TiO₂ for added ductility for wear applications DSM-0387

3 Coating Information

3.1 Key Thermal Spray Coating Information

Specification	Typical Data
Recommended Spray Process ^a	Atmospheric Plasma Spray, Combustion Powder Thermospray™ or HVOF-GF
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 F4MB-XL series
	TriplexPro series
	SinplexPro series
HVOF-GF	
DJH2600	

4 Commercial Information

4.1 Ordering Information and Availability

	Order No.	Package Size	Availability	Distribution
Metco 102	1000079	5 lb (approx. 2.25 kg)	Stock	Global
Amdry 6505	1005562	10 kg (approx. 22 lb)	Stock	Global
Amdry 6510	1002834	10 kg (approx. 22 lb)	Stock	Global
Amdry 6515	2449876	10 kg (approx. 22 lb)	Make-to Order	Global

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 50-136 (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).