

Product Information

Titanium Oxide S Patinal®

GENERAL INFORMATION

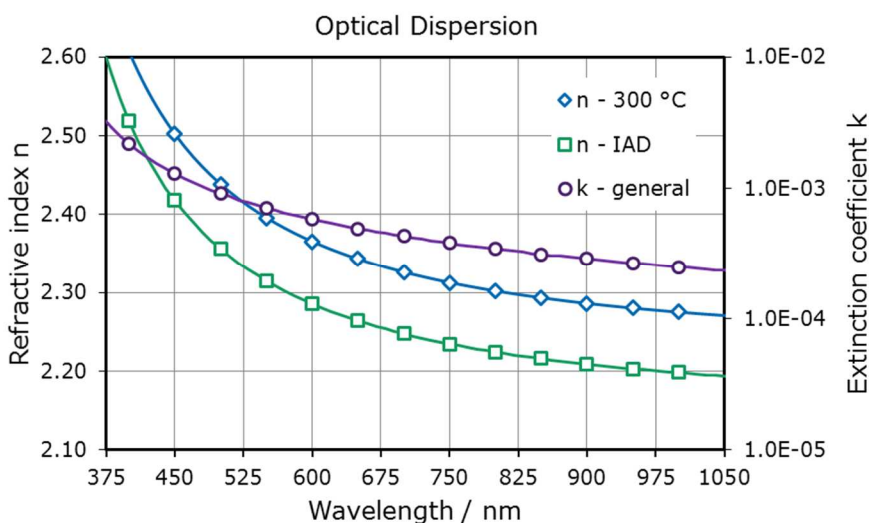
Titanium Oxide S Patinal® is one of the preferred Ti-suboxides used to manufacture thin films of TiO₂. For this purpose the material is evaporated reactively. The advantage of Titanium Oxide S Patinal® over TiO₂ is less outgassing during preparation of the melt due to the favorable oxygen-to-titanium ratio of 1.7. This results in a shorter preparation time to achieve stable process conditions before the start of the evaporation process, and less risk of spattering.

AREAS OF APPLICATION

- AR and multilayer coatings on glass and plastic substrates
- UV protection for plastic substrates

THIN FILM PROPERTIES

Chemical formula	TiO _{1.7}
Range of transparency	400 nm – 12 μm
Refractive index at 500 nm	~ 2.40
Absorption edge	~ 390 nm
Thin film stress	Tensile



The resulting optical properties of the thin film are strongly dependent on the deposition rate, substrate temperature and oxygen partial pressure. Strict control of these parameters allows excellent reproducibility.

wavl / nm	400	500	600	750	900	1050
n - IAD	2.60	2.44	2.37	2.31	2.29	2.27
n – 300 °C	2.52	2.36	2.29	2.23	2.21	2.20
k - general	2.0E-04	9.0E-04	5.8E-04	3.8E-04	2.8E-04	2.4E-04

NOTES FOR EVAPORATION

Evaporator source	Resistance heated thermal evaporator Electron beam evaporator
Boat / liner	Ta or W boat Copper crucible or Mo liner
Melting temperature	About 1800 °C
Deposition rate	~0.2 – 0.4 nm/s
Oxygen partial pressure	1-2·10 ⁻⁴ mbar
Substrate temperature	Conventional (without IAD): 250 to 350 °C
QCR-settings	Density 4.26 g/cm ³ , z-ratio 0.4

Evaporation conditions are similar to those for titanium(IV) oxide (TiO₂).

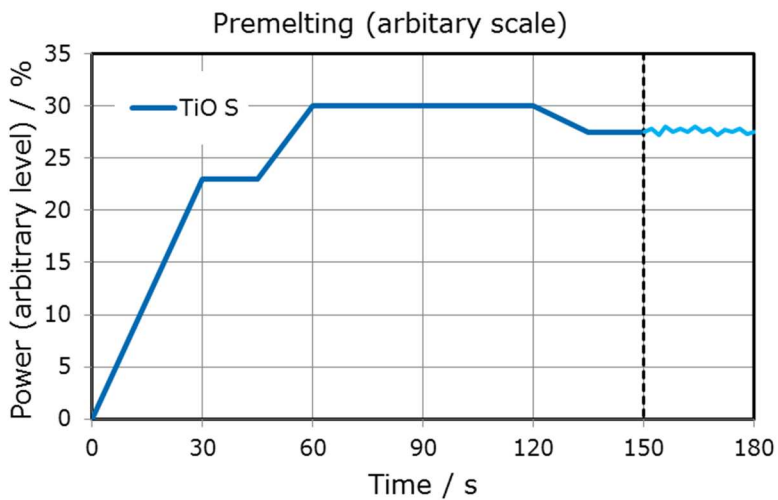
Titanium metal (Ti) or different titanium oxide modifications, e.g. TiO, Ti₂O₃, TiO₂, can be used as evaporation material to deposit titanium dioxide (TiO₂) layers, but only Titanium Oxide S Patinal[®] has a metal / oxygen ratio of about 1.7, the ratio found in premelted material for the other titanium oxides. This permits the vacuum operator to skip time consuming material preparation steps in the coating process and to avoid disadvantages of other titanium oxide modifications.

The reproducibility of the refractive index is improved. Also, the degassing (release of oxygen) during preheating & premelting as experienced using titanium dioxide (TiO₂) does not occur. As a consequence, the material shows very little spitting.



Deposition can be started after only a short preheating / premelting cycle. The melt of Titanium Oxide S Patinal® can easily be refilled without any issues.

The following figure shows the preconditioning process used:



PRODUCTS

Titanium Oxide S Patinal® is available as granules and pellets.

Product Code	Description	Purity*	Dimensions
1.16828	Titanium Oxide S Granules Patinal®	≥ 99.95 % (3N5)	Granules, about 1 – 4 mm
1.16700	Titanium Oxide S Pellets Patinal®	≥ 99.95 % (3N5)	Pellets, about Ø 10 mm x h 5.5 mm

* The purity values are based on the specified trace metals.

Appearance

1.16828	Black violet
1.16700	Black violet

SPECIFICATION

Cobalt (Co)	≤ 0.0005 %
Copper (Cu)	≤ 0.001 %
Chromium (Cr)	≤ 0.005 %
Iron (Fe)	≤ 0.02 %
Vanadium (V)	≤ 0.01 %

Sizes

1.16828	Granules 1 - 4 mm ≥ 80 %
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Application test

Each batch has to pass a specific application test assessing its evaporation behaviour.

RoHS information

The RoHS compliance information is part of the Certificate of Analysis (CoA) for each batch of Patinal® material.



Quality assurance

Research, production and sales of our Patinal® evaporation materials take place under a certified DIN EN ISO 9001 quality management system and DIN EN ISO 14001 environmental management system. The quality of the materials is assured by our manufacturing processes, in-process controls and quality tests. Each batch is released only after passing our chemical analysis and application tests designed to confirm the suitability of the material for the evaporation process.

Handling precautions

Product safety information required for safe use is not included in this document. Before handling, read product and safety sheets and container labels for safe use, physical and health hazard information. The material safety data sheet is available online at www.patinal.com, from your EMD representative or distributor, or by calling your global Merck KGaA, Darmstadt, Germany, contact.

Disclaimer

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