Product Information

Aluminium Oxide Patinal®

GENERAL INFORMATION

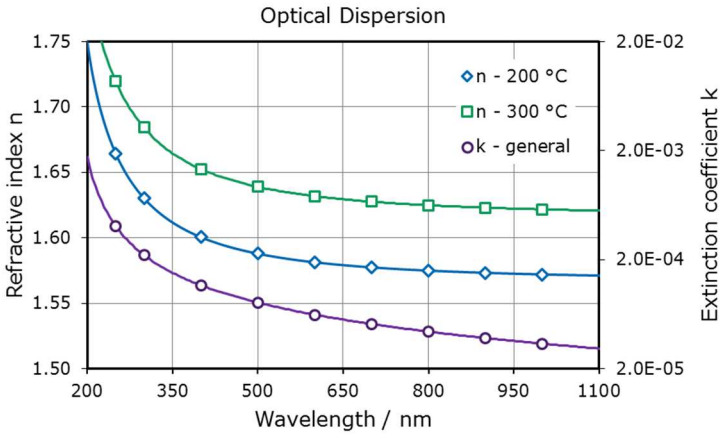
Aluminium oxide is a widely used material for multilayer coatings such as AR and HR coatings in the UV, VIS and NIR range. It generally shows good adhesion to oxide, metallic and plastic surfaces and and a good barrier performance.

AREAS OF APPLICATION

- AR and multilayer coatings for e.g. filters, mirrors, beamsplitters in the UV, VIS und NIR range
- Protective coatings for metal mirrors
- Dielectric layers for electronic applications, e.g. thin film hybrid circuits
- Adhesion promoter

THIN FILM PROPERTIES

Range of transparency	200 nm – 5 µm
Refractive index at 500 nm	
• Conventional T_s = 300°C / no IAD	~ 1.64
• Conventional T_s = 200°C / no IAD	~ 1.59
Thin film stress	Compressive



EMD Performance Materials*
1200 Intrepid Ave, Suite 300 / Philadelphia, PA / 19112 USA
+888 367 3275 / photonicsUS@emdgroup.com / patinal.com
* EMD Performance Materials is a business of Merck KGaA, Darmstadt, Germany

The resulting optical properties of the thin film are dependent on process conditions such as deposition rate and substrate temperature.

wavl / nm	250	350	500	650	800	1110
n - 200 °C	1.664	1.612	1.588	1.579	1.575	1.571
n - 300 °C	1.720	1.665	1.639	1.629	1.625	1.621
k - general	4.1E-04	1.5E-04	8.1E-05	5.6E-05	4.4E-05	3.0E-05

NOTES FOR EVAPORATION

Evaporator source	Electron beam evaporator
Liner	Water cooled copper crucible
Evaporation temperature	2000 – 2200 °C
Deposition rate	0.4 – 1.0 nm/s preferably 0.2 – 0.4 nm/s
Oxygen partial pressure	about $1.0 \cdot 10^{-4}$ mbar
IAD settings (Leybold Optics APS)	110 – 120 V Bias, 15 – 20 sccm O_2
Substrate temperature	Conventional 150 to 350 °C, preferably 300°C IAD @ RT – 200 °C, preferably 110 - 150 °C
QCR-settings	Density 3.97 g/cm³, z-ratio 0.336

It is highly advisable to work with low energy-density or with a greatly extended beam spot to avoid splashing during evaporation. The characteristics of the vapor deposited films depend on the substrate temperature during evaporation. For temperatures around 300 °C in particular, compact, hard films with high refractive index are obtained.

Aluminium oxide can be evaporated reactively as well as non-reactively. A typical oxygen partial pressure of $1 \cdot 10^{-4}$ mbar should be selected for reactive evaporation.

EMD Performance Materials*
1200 Intrepid Ave, Suite 300 / Philadelphia, PA / 19112 USA
+888 367 3275 / photonicsUS@emdgroup.com / patinal.com
* EMD Performance Materials is a business of Merck KGaA, Darmstadt, Germany

PRODUCTS

Aluminium Oxide Patinal® is available as granules in different size distributions.

Product Code	Description	Purity*	Dimensions
1.15345	Aluminium Oxide Granules Patinal®	≥ 99.99 % (4N)	Granules, about 1 – 3 mm
1.01058	Aluminium Oxide Granules Patinal®	≥ 99.99 % (4N)	Granules, about 1 – 5 mm

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

Appearance	
1.15345	Colorless granules
1.01058	Colorless granules

SPECIFICATION

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

RoHS information

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

Sizes	
1.15345	Granules 1 - 3 mm ≥ 80 %
1.01058	Granules 1 – 5 mm ≥ 80 %

Application test

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

EMD Performance Materials*
1200 Intrepid Ave, Suite 300 / Philadelphia, PA / 19112 USA
+888 367 3275 / photonicsUS@emdgroup.com / patinal.com
* EMD Performance Materials is a business of Merck KGaA, Darmstadt, Germany

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

Products are warranted to meet the specifications set forth on their label/packaging and/or certificate of analysis at the time of shipment or for the expressly stated duration. EMD MAKES NO REPRESENTATION OR WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING MERCHANTABILITY OR FITNESS FOR A PARTICULAR USE REGARDING OUR PRODUCTS OR ANY INFORMATION PROVIDED IN CONNECTION THEREWITH. Customer is responsible for and must independently determine suitability of EMD´s products for customer's products, intended use and processes, including the non-infringement of any third parties´ intellectual property rights. EMD shall not in any event be liable for incidental, consequential, indirect, exemplary or special damages of any kind resulting from any use or failure of the products: All sales are subject to EMD's complete Terms and Conditions of Sale. Prices are subject to change without notice. EMD reserves the right to discontinue products without prior notice.

EMD Performance Materials*
1200 Intrepid Ave, Suite 300 / Philadelphia, PA / 19112 USA
+888 367 3275 / photonicsUS@emdgroup.com / patinal.com
* EMD Performance Materials is a business of Merck KGaA, Darmstadt, Germany