

Product Information

Ytterbium Fluoride Patinal®

GENERAL INFORMATION

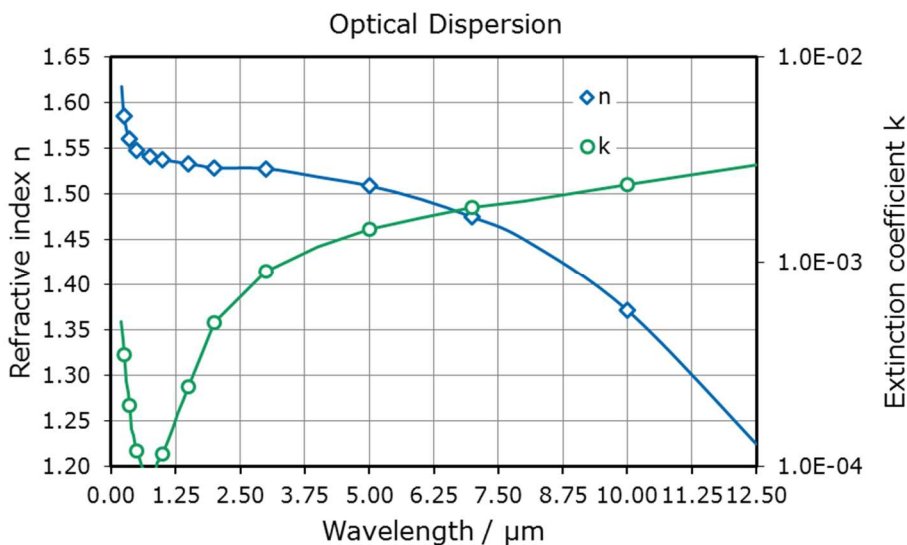
Thin films made from Ytterbium Fluoride Patinal® can be used for optical coatings from the UV to the MIR spectral range and show very good durability. They pass environmental tests of moderate abrasion, tape and adhesion even after 24 hours of humidity.

AREAS OF APPLICATION

- Multilayer coatings for UV, NIR and MIR spectral range
- Alternative to thorium fluoride for coatings in the IR spectral range

THIN FILM PROPERTIES

Range of transparency	200 – 12 μm
Refractive index	
• at 500 nm	~ 1.55
• at 10 μm	~ 1.37
Thin film stress	Tensile (low)



wavl / μm	0.25	0.35	0.50	0.75	1.00	2.00	5.00	7.00	10.00	12.50
n	1.585	1.560	1.548	1.541	1.538	1.529	1.509	1.475	1.372	1.225
k	3.5E-4	2.0E-4	1.2E-4	8.7E-5	1.1E-4	5.0E-4	1.5E-3	1.8E-3	2.4E-3	3.0E-3

Because of its low film stress, it can be used for coating layers with a thickness of $> 2 \mu\text{m}$. MgF_2 tends to be limited to a layer thickness of $< 1 \mu\text{m}$ because of film stress and growing porosity. Compared to most other fluorides YbF_3 shows lower tensile film stress.

Even lower stress and improved durability can be achieved by splitting thick layers into two thinner layers with an adhesion promoter of medium refractive index in between (e.g. ZnS , Y_2O_3 or HfO_2).

YbF_3 shows very low water absorption bands at 3 and 6 μm , even shallower than e.g. YF_3 .

NOTES FOR EVAPORATION

Evaporator source	Resistance heated evaporator Electron beam evaporator
Boat / liner	Mo and Ta boat Mo liner
Evaporation temperature	$\sim 1400 - 1600 \text{ }^\circ\text{C}$
Deposition rate	0.8 – 1.5 nm/s
Substrate temperature	150 - 200 $^\circ\text{C}$ preferably $\sim 160 \text{ }^\circ\text{C}$ in combination with ZnS
QCR-settings	Density 8.168 g/cm ³ , z-ratio 1.0

E-beam evaporation requires well optimized e-beam settings with low energy density to avoid decomposition.

YbF_3 passes moderate abrasion requirements. But YbF_3 and fluorides in general tend to form soft layers compared to oxides. If severe abrasion requirements have to be fulfilled a hard coating material has to be applied as a scratch resistant layer (e.g. Y_2O_3 , Al_2O_3 , DLC) on top.

Ion assisted deposition (IAD) can be used to enhance the density and hardness of YbF_3 layers without introducing additional absorption and significantly reducing water absorption bands.



PRODUCTS

Ytterbium Fluoride Patinal® is available as crystalline granules.

Product Code	Description	Purity*	Dimensions
1.01601	Ytterbium Fluoride Granules Patinal®	≥ 99.95 % (3N5)	Granules, less than 1.6 mm

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

Appearance

1.01601	White / cream crystalline powder
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SPECIFICATION

Cobalt (Co)	≤ 0.001 %	Sizes	
Copper (Cu)	≤ 0.001 %	1.01601	Granules < 1.6 mm ≥ 90 %
Chromium (Cr)	≤ 0.001 %		
Iron (Fe)	≤ 0.002 %	Application test	
Manganese (Mn)	≤ 0.001 %	Each batch has to pass a specific application test assessing its evaporation behaviour.	
Lead (Pb)	≤ 0.005 %		
Oxygen (O)	≤ 0.1 %		

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.

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