

## Magnesium Fluoride Patinal®

### GENERAL INFORMATION

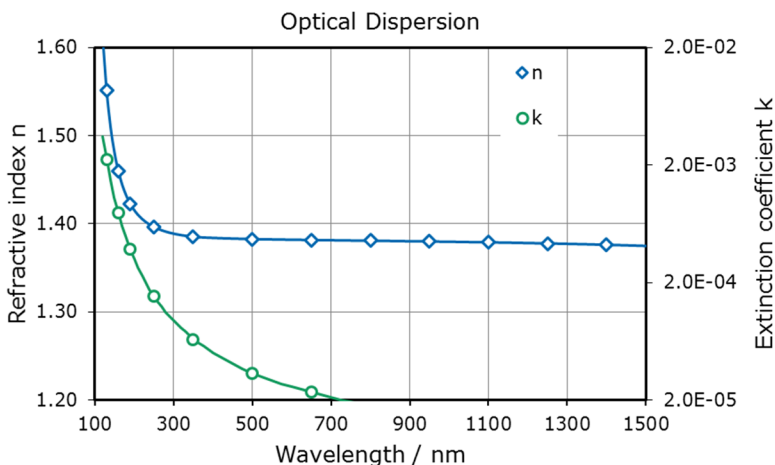
Magnesium fluoride is by far the most used low index material in the wavelength region UV-NIR. In the IR above 4  $\mu\text{m}$ , Magnesium fluoride is usually not applied since thicker layers show intrinsic stress and thus tend to crack.

### AREAS OF APPLICATION

- Antireflection (AR) coatings on glass for VIS and NIR
- Multilayer coatings for beam-splitters, filters
- Low index material for UV excimer laser wavelengths, e.g. at 157 nm and 193 nm
- Protective layers, e.g. on aluminium

### THIN FILM PROPERTIES

Range of Transparency	120 nm – 7 $\mu\text{m}$
Refractive index at 500 nm	$\sim 1.38$
Thin Film Stress	Tensile
Packing Density	
• at 20 °C	0.72
• at 300 °C	0.98



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wavl / nm	120	160	250	350	500	800	1200	1500
n	1.612	1.459	1.396	1.385	1.383	1.381	1.378	1.375
k	3.5E-03	7.8E-04	1.5E-04	6.5E-05	3.4E-05	<2.0E-05	<2.0E-05	<2.0E-05

## NOTES FOR EVAPORATION

Evaporator source	Resistance heated thermal evaporator Electron beam evaporator
Boat / Liner	W, Mo, Ta or Pt-Boat Copper crucible
Evaporation temperature	1300 – 1600 °C
Deposition rate	0.5 – 5 nm/s
Substrate temperature	200 – 300 °C, pref. 300 °C
QCR-settings	Density 3.18 g/cm <sup>3</sup> , z-ratio 0.637

The refractive index of magnesium fluoride layers is only slightly influenced by evaporation conditions and therefore very stable. Magnesium fluoride can be evaporated with high rates and hard, compact and stable films are achieved when the material is deposited onto hot substrates (substrate temperature about 300 °C). Deposition onto unheated substrates yields porous and poorly adhering films. Magnesium fluoride layers for UV applications should be deposited by electron beam evaporation. To minimize spitting thorough fusing of the magnesium fluoride granules in the premelting phase and a regular renewal of the used material is required. The use of resistance-heated boats - especially made of tantalum - can have a negative impact on the optical performance of the MgF<sub>2</sub> thin film.



## PRODUCTS

Magnesium Fluoride Patinal® is available as powder, granules and also as special low oxide granules. Magnesium Fluoride LO Patinal® has a low oxygen content of  $\leq 0.02\%$  to further reduce the probability of spitting compared to  $\leq 0.06\%$  for the standard quality. All other parameters are identical to the other products in granular form.

Product Code	Description	Purity*	Dimensions
1.05846	Magnesium Fluoride Granules Patinal®	$\geq 99.995\%$ (4N5)	Granules, < 1 mm
1.05849	Magnesium Fluoride Granules Patinal®	$\geq 99.995\%$ (4N5)	Granules, 0.3 - 1 mm
1.05823	Magnesium Fluoride Granules Patinal®	$\geq 99.995\%$ (4N5)	Granules, 1 – 2.5 mm
1.05845	Magnesium Fluoride Granules Patinal®	$\geq 99.995\%$ (4N5)	Granules, 1 – 4 mm
1.05834	Magnesium Fluoride Granules Patinal®	$\geq 99.995\%$ (4N5)	Granules, 2.5 – 4 mm
1.10261	Magnesium Fluoride LO Granules Patinal®	$\geq 99.995\%$ (4N5)	Granules, 1 – 4 mm

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

### Appearance

1.05846	White or colorless crystalline granules
1.05849	White or colorless crystalline granules
1.05823	White or colorless crystalline granules
1.05845	White or colorless crystalline granules
1.05834	White or colorless crystalline granules
1.10261	White or colorless crystalline granules



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## SPECIFICATION

Cobalt (Co)	≤ 0.0005 %
Copper (Cu)	≤ 0.0005 %
Chromium (Cr)	≤ 0.0005 %
Iron (Fe)	≤ 0.001 %
Vanadium (V)	≤ 0.001 %
Oxygen (O)	≤ 0.06 % ≤ 0.02 % for 1.10261

### 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.

### Sizes

1.05846	Granules < 1mm, ≥ 90 %
1.05849	Granules 0.3 -1 mm, ≥ 80 %
1.05823	Granules 1 – 2.5 mm, ≥ 80 %
1.05845	Granules 1 – 4 mm, ≥ 80 %
1.05834	Granules 2.5 -4 mm, ≥ 80 %
1.10261	Granules 1 -4 mm, ≥ 80 %



## 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](http://www.patinal.com), from your EMD representative or distributor, or by calling your global Merck KGaA, Darmstadt, Germany, contact.

## Disclaimer

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