

## Product Information

# Zinc Sulfide Patinal®

### GENERAL INFORMATION

Zinc sulfide is mainly used for IR optical applications (e.g. AR coatings on Ge, thermal imaging) and can be evaporated easily from resistively heated boats resulting in durable coatings. It has a broad transmission range from 400 nm up to 14  $\mu\text{m}$ . ZnS can be applied as high refractive index material in the VIS-NIR range in combination with fluorides such as  $\text{MgF}_2$ , although in many of these applications it nowadays has been being replaced by the harder oxidic materials such as  $\text{TiO}_2$ .

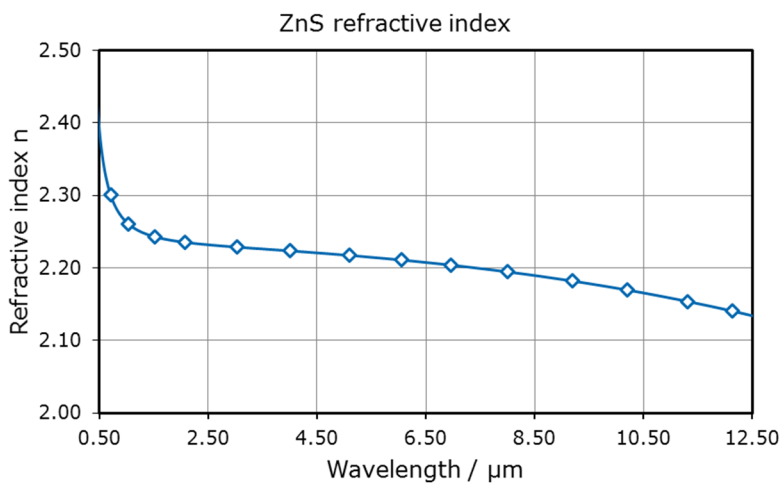
### AREAS OF APPLICATION

- Multi-layer coatings in the VIS and IR up to 14  $\mu\text{m}$  for mirrors, beam splitters and AR
- Heat protection films for window glass
- Decorative coatings for iris effects in combination with films of magnesium fluoride



## THIN FILM PROPERTIES

Range of transparency	400 nm – 14 $\mu$ m
Refractive index	
• at 500 nm	~ 2.35
• at 10 $\mu$ m	~ 2.15
Thin film stress	Compressive



wavl / $\mu$ m	0.45	0.70	1.00	2.00	4.00	6.00	8.00	10.00	13.00
n	2.44	2.30	2.26	2.24	2.22	2.21	2.19	2.17	2.12

Zinc Sulfide Patinal® can be used in combination with fluorides (e.g. MgF<sub>2</sub>) in the VIS for multilayer coatings. In the IR it can be combined with YbF<sub>3</sub>, YF<sub>3</sub> and Ge for durable coatings. On germanium substrates it acts as a low refractive index material, therefore it can be used as a single layer AR on Ge.

ZnS layers grow in compressive stress mode, therefore they can be used to compensate tensile film stress of fluoride layers.



## NOTES FOR EVAPORATION

Evaporator source	Resistance heated evaporator (mainly used) Electron beam evaporator
Boat / liner	Mo, Ta or Pt boat Al or vitreous carbon liner (indirectly heated) Mo or Ta liner, vitreous carbon liner
Evaporation temperature	1000 – 1100 °C
Deposition rate	0.8 – 2.5 nm/s
Chamber pressure	< 2·10 <sup>-5</sup> mbar For IR < 1·10 <sup>-6</sup> mbar
Substrate temperature	150 to 160 °C
QCR-settings	Density 4.09 g/cm <sup>3</sup> , z-ratio 0.775

Zinc sulfide sublimates and tends to decompose into zinc and sulfur during evaporation. Recombination occurs during condensation onto the substrate. The adherence and stability of zinc sulfide films greatly depend on cleanliness of the substrate. It is advisable to clean the substrates very carefully, e.g. with Extran® in an ultrasonic machine, and to expose them to a glow discharge before deposition. Particularly stable films are obtained at a substrate temperature of about 150 °C.

The optical properties of the film depend on the deposition conditions. In order to obtain absorption-free films it is necessary to deposit slowly at a rate of less than 2.5 nm/s. To avoid the formation of zinc oxide, the chamber pressure should be kept below 2·10<sup>-5</sup> mbar. For anti-reflection coatings in the IR at 10.6 μm a pressure of 10<sup>-6</sup> – 10<sup>-7</sup> mbar is recommended, and a rate of 0.8 - 1 nm/s.

Following these hints, very stable, absorption-free zinc sulfide films can be made, that do not crack even at greater film thickness.



## PRODUCTS

Zinc Sulfide Patinal® is available as tablets or sublimed granules.

Product Code	Description	Purity*	Dimensions
1.08885	Zinc Sulfide Patinal®	≥ 99.95 % (3N5)	Tablets, about 1.5 g
1.08898	Zinc Sulfide Sublimed Patinal®	≥ 99.99 % (4N)	Granules, about 1 – 4 mm

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

### Appearance

1.08885	White tablets
1.08898	Yellow granules

## SPECIFICATION

Cobalt (Co)	1.08885 ≤ 0.005 % 1.08898 ≤ 0.001 %	Sizes	
Copper (Cu)	1.08885 ≤ 0.005 % 1.08898 ≤ 0.0005 %	1.08885	h = 5.7 – 6.7 mm Ø = 9.5 – 10.5 mm
Chromium (Cr)	≤ 0.001 %	1.08898	Granules 1- 4 mm ≥ 80 %
Iron (Fe)	1.08885 ≤ 0.005 % 1.08898 ≤ 0.002 %	Application test	
Vanadium (V)	≤ 0.005 %	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](http://www.patinal.com), from your EMD representative or distributor, or by calling your global Merck KGaA, Darmstadt, Germany, contact.

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