

## Substance M5 Patinal®

### GENERAL INFORMATION

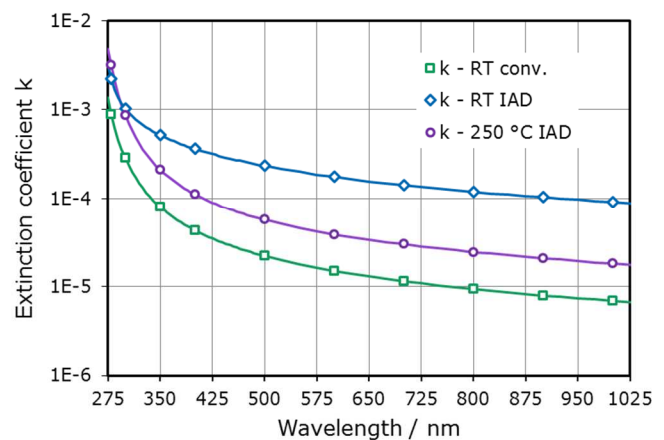
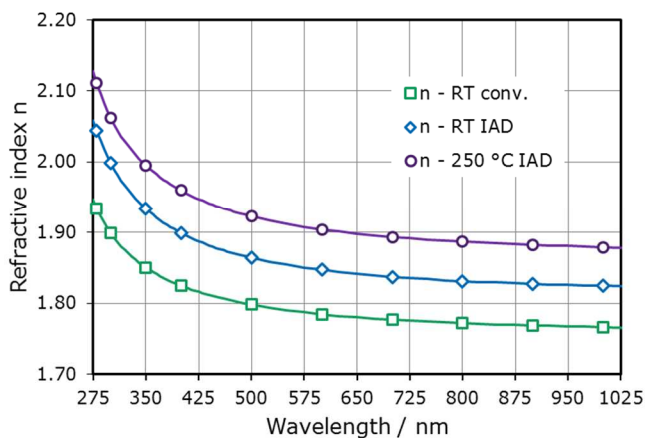
Substance M5 Patinal® is a medium refractive index material composed of a mixture of aluminium oxide and tantalum oxide. It was developed as a very stable and durable material for applications in the VIS to IR and is available as granules. This product is not available for sale in Japan.

### AREAS OF APPLICATION

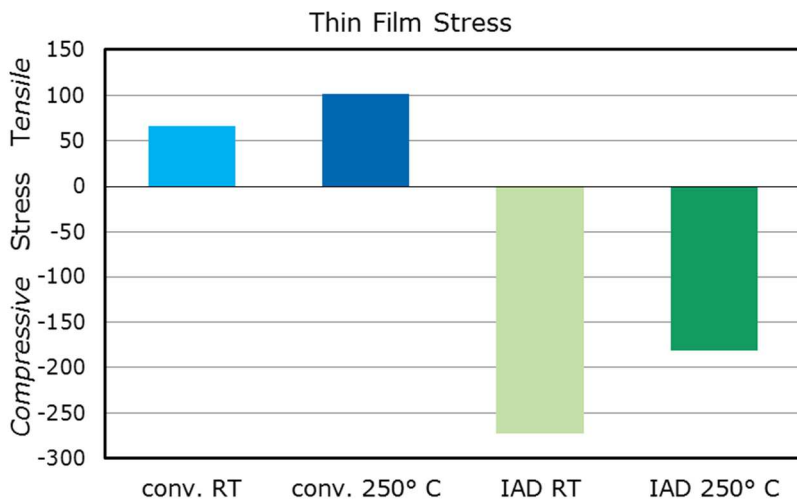
- Ophthalmics, AR coatings on polymers
- BBAR coatings for precision optics
- Coatings with high requirements on hardness and environmental durability

### THIN FILM PROPERTIES

Range of transparency	280 nm – 8 μm
Refractive index at 500 nm	
• conventional $T_s = RT$ °C / no IAD	~ 1.77
• IAD – $T_s = RT$	~ 1.83
Thin film stress	Compressive to tensile



wavl / nm	275	300	350	400	500	700	1000	2000
n - RT conv.	1.95	1.90	1.85	1.82	1.80	1.78	1.77	1.76
n - RT IAD	2.06	2.00	1.93	1.90	1.86	1.84	1.82	1.82
n - 250 °C IAD	2.13	2.06	2.00	1.96	1.92	1.89	1.88	1.87
k - RT conv.	1.4E-03	2.9E-04	8.1E-05	4.3E-05	2.2E-05	1.1E-05	6.9E-06	3.1E-06
k - RT IAD	3.2E-03	1.0E-03	5.2E-04	3.6E-04	2.3E-04	1.4E-04	9.1E-05	4.3E-05
k - RT 250 °C	4.8E-03	8.7E-04	2.1E-04	1.1E-04	5.7E-05	3.0E-05	1.8E-05	8.3E-06



Condition	Film thickness / nm	Stress $\sigma$ / MPa
conv. RT	348	67
conv. 250° C	367	102
IAD RT	346	-273
IAD 250° C	355	-182

Film stress was measured for different process conditions with and without substrate heating and ion assistance. The measurements were performed with a Toho Technology Corp FLX-2320-S two weeks after the deposition process.



## NOTES FOR EVAPORATION

Evaporator source	Electron beam evaporator
Liner	Copper crucible or Mo liner
Melting temperature	about 1500 °C
Evaporation temperature	about 2100 °C
Deposition rate	0.2 – 0.8 nm/s
Oxygen partial pressure	about $2 \cdot 10^{-4}$ mbar
IAD settings (RF source)	IAD with O <sub>2</sub> , 1000 mA – 1000 V
Substrate temperature	conventional RT – 100 °C IAD @ RT – 250 °C
QCR-settings	Density 6.5 g/cm <sup>3</sup> , z-ratio 1.0

Substance M5 Patinal® requires e-beam evaporation. Prior to deposition of the coatings the material has to be premelted below a shutter. To form a melted plug it is necessary to do premelting and refilling in several steps.



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## PRODUCTS

Substance M5 Patinal® is available\* as granules.

Product Code	Description	Purity**	Dimensions
1.02370	Substance M5 Patinal®	≥ 99.95 % (3N5)	Granules, about 1 – 4 mm

\* This material is not available for sale in Japan.

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

### Appearance

1.02370	White granules
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## SPECIFICATION

Cobalt (Co)	≤ 0.005 %
Copper (Cu)	≤ 0.005 %
Chromium (Cr)	≤ 0.005 %
Iron (Fe)	≤ 0.01 %
Manganese (Mn)	≤ 0.005 %
Vanadium (V)	≤ 0.005 %

### Sizes

1.02370	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](http://www.patinal.com), from your EMD representative or distributor, or by calling your global Merck KGaA, Darmstadt, Germany, contact.

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