Patinal®

Evaporation Materials

PRODUCT INFORMATION

Substance WR4 Patinal®

EMD Chemicals Inc. Phone 856-423-6300
Internet: www.emdchemicals.com Mail: optics@emdchemicals.com

NOTES AND EXPLANATIONS

We advise our customers regarding technical applications to the best of our knowledge within the scope of the possibilities open to us, but without obligation. Current laws and regulations must be observed at all times. This also applies in respect to any protected rights of third parties. Our suggestions do not relieve our customers of the necessity to test our products, on their own responsibility, for suitability for the purpose envisaged. Quotations from our literature are only permitted with our written authority, and the source must be stated.

This product information sheet is based on our own investigations and on literature data. The properties of the materials in thin coatings are affected by the choice of deposition conditions. For this reason, coating properties quoted are to be understood as being typical values and cannot be guaranteed. As far as possible, the conditions under which the coating properties were achieved are indicated.

QUALITY CONTROL

During quality control of the products analyses were performed with the aim to measure those properties of the products which are of major importance for the applicability of the products and the properties of the coatings. Chemical analysis is performed to determine the specified impurities. Furthermore application testing is performed to analyze the behavior of the product during melting and evaporation. Also thin coatings are made to analyze transmittance and refractive index. The values listed in the specification are guaranteed impurity limits determined on representative samples of each production batch.

SAFETY NOTE

Working safety requires that products which are formed during evaporation to be kept in the closed system. If fine dust develops during cleaning of evaporation equipment suitable respiratory protection must be provided (approved respirators).

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GENERAL

Substance WR4 Patinal® was developed for the production of super-hydrophobic coatings on AR coatings by vacuum evaporation. Opposite to the well-known WR substances from Merck, Substance WR4 Patinal® has the following advantages:

- Besides its hydrophobic properties, Substance WR4 Patinal® is also oleophobic, which eases the cleaning from e.g. fatty fingerprints.
- Substance WR4 Patinal® forms very durable and well adhering coatings on both silicate and fluoride surfaces.
- Thus lenses made from both mineral glass and plastics can be coated.

Substrates coated with Substance WR4 Patinal® on AR coated glass or plastic lenses exhibit a very low wettability by water and therefore a lowered tendency to be contaminated by grease and finger prints which are especially troublesome in case of highly efficient AR coatings.

Substance WR4 Patinal® consist of tablets made of an metallic carrier doped with the hydrophobic substance. One tablet of 11 mm diameter and 7 mm thickness is used for one coating run.

To avoid decomposition of the active substance, Substance WR4 Patinal® has to be stored in the sealed package at low temperature. We recommend storage below +25 °C. Refrigerator or freezer storage is also possible and extends the maximum shelf life.

ITEMS AND PACKAGING SIZES

1.01822.0003	Substance WR4 tablets 0.05 Patinal® Package with 5 tablets

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SPECIFICATION

1.01822 Substance WR4 tablets 0.05 Patinal®

Thickness	
min	≥ 6.5 mm
max	≤ 7.5 mm
Diameter	
min	≥ 10.5 mm
max	≤ 11.5 mm
Active substance	≥ 0.05 g/tabl.
Application test	confirms
Coating properties (Contact angle for water)	≥ 110 °

RoHS information:

Cd (Cadmium)	≤ 0,01 %
Cr (Chromium)	≤ 0,1 %
Hg (Mercury)	≤ 0,1 %
Pb (Lead)	≤ 0,1 %
PBB (polybrominated biphenyls)	≤ 0,1 %
PBDE (polybrominated diphenyl ethers)	≤ 0,1 %

The Chromium(VI) concentration (RoHS requirements: ≤ 0.1 %) is always smaller than or equal to the total chromium concentration.

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APPLICATION

The substance is heated to a temperature where the active substance evaporates (350-450°C). Evaporation can be performed using resistively heated box type boats made of molybdenum or tantalum. Evaporation with e-beam gun is also possible. Preferably, a Mo- or Ta-liner with perforated cover has to be used. It is recommendable, that the liner has little thermal contact to the Cu crucible. In case of good thermal contact, the hydrophobic substance might not be evaporated quantitatively.

The evaporated substance forms a thin layer on the substrate. Optimum layer properties are obtained for films of 20 nm thickness and a storage time of at least one day. Durable films with good adhesion can be made onto oxide films, especially silicon oxide films, on lenses made of mineral glass or plastic. The substance can also be deposited on fluoride films, e.g. coatings of magnesium fluoride on mineral glass, resulting in well-adhering, durable layers.

PROPERTIES OF COATINGS

The contact angle against water is at least 110°.

The refractive index is about 1.5 in the visible spectral range. Because of the low thickness of the layer, changes in reflectance of AR coatings are small. Optimum results are achieved after adjusting the layer thicknesses of the AR coating.

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HINTS ON EVAPORATION

The coating procedure is described by an experiment performed in a box coater L560 made by Leybold Systems, Germany.

The substrates are positioned on the substrate holder. The distance between evaporation source and substrate holder is about 400 mm.

Evaporation source:	box type boat made of molybdenum sheet
Evaporation temperature:	about 360 to 450 °C controlled by thermocouple fixed at the boat
Substrates:	glass slides 50x50 mm or CR 39 slides 25 mm diameter cleaned in ultrasonic bath with Extran (1.07555) 5% in demineralized water rinsed with demineralized water dried at 80 °C in air
Substrate temperature:	non-heated or weakly heated to about 80 °C

One tablet of Substance WR4 Patinal® is placed in a box type boat made of molybdenum sheet. The cleaned and dried substrates are fixed at the substrate holder. The coating chamber is pumped down to a base pressure of about $2 * 10^{-5}$ mbar. The substrates are heated to about 80 °C.

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The substrates are first coated with an antireflection coating e.g. a four layer AR coating consisting of Substance H4 and Silicon dioxide. Then the hydrophobic coating is deposited by rising the temperature of the boat in 30 to 60 seconds to the evaporation temperature of about 360 to 450 °C. The shutter remains open from the beginning. Evaporation starts after approximately 60 sec. and is carried out until a film thickness of 20 nm is reached (Quartz crystal thickness monitor, density 1.5 g/cm^3). After cooling down the chamber is vented with air and opened.

The hydrophobic coating does not need any post-treatment. The coating is hydrophobic. Contact angle against water is at least 110°. Optimum coating properties are obtained after one day storage time.

The films are durable. No major deterioration occurred by wiping with cloth or after boiling in de-ionized water for 15 minutes.

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