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 Patinal®

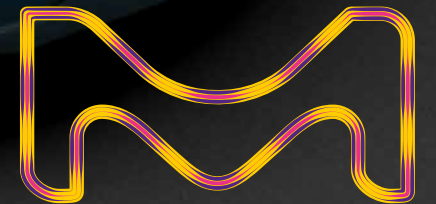
EMD
PERFORMANCE
MATERIALS

visionary optics for automobiles

Patinal® coatings for automotive applications



EMD Performance Materials is a business of
Merck KGaA, Darmstadt, Germany





Making quality visible

Merck KGaA, Darmstadt Germany is a leading manufacturer of innovative and high-tech products in healthcare, life science and performance materials. With around 50,000 employees working in 66 countries, we work to improve quality of life, further the success of our customers, and meet global challenges together.

As part of Performance Materials, EMD Photonics is your reliable source of and partner in high-quality materials for optical applications. Take advantage of our more than 30 years of experience and global presence in the field.

Patinal® evaporation materials have been designed to meet the specific requirements of optical thin film production by physical vapor deposition (PVD), the method of choice for many industrial applications. Our product range comprises more than 40 evaporation materials, including fluorides, oxides, sulfides, and metals. These are available as granules, tablets or discs to fulfill your reliability and productivity needs.

All our Patinal® materials are manufactured and tested to the highest quality and processing standards. They have a proven track record as materials of choice to achieve superior optical performance. Special Patinal® mixtures have been designed to work on various substrates and increase the robustness of your valuable optical coating.

With our technological leadership, we make quality visible – and beneficial to you.



self-driving cars...

Imagine never being stuck in a traffic jam again while heading off on vacation.

Imagine being able to use your commute as productively as being in the office, while traveling more safely than ever.

Imagine living in a world where there is no need to worry about your loved ones getting home safely.

Imagine all this is possible with cars that have neither pedals nor a steering wheel.

Driving will never be the same again. And this future is closer than most people think. All the top automotive manufacturers are developing self-driving cars, with the first ones expected on the road in the near future.

Autonomous cars will reduce the number of traffic jams, which will have a positive impact on the environment. Advanced driver-assistance systems and autonomous cars will also make the roads a safer place for everybody: for drivers, cyclists, pedestrians, and children.

... that can see!

In a couple of years, cars will be able to scan the surrounding area so that drivers do not have to. To do so, cars will be equipped with up to 12 cameras. Cameras are the most important component of state-of-the-art driver-assistance systems and will play a key role in autonomous driving.

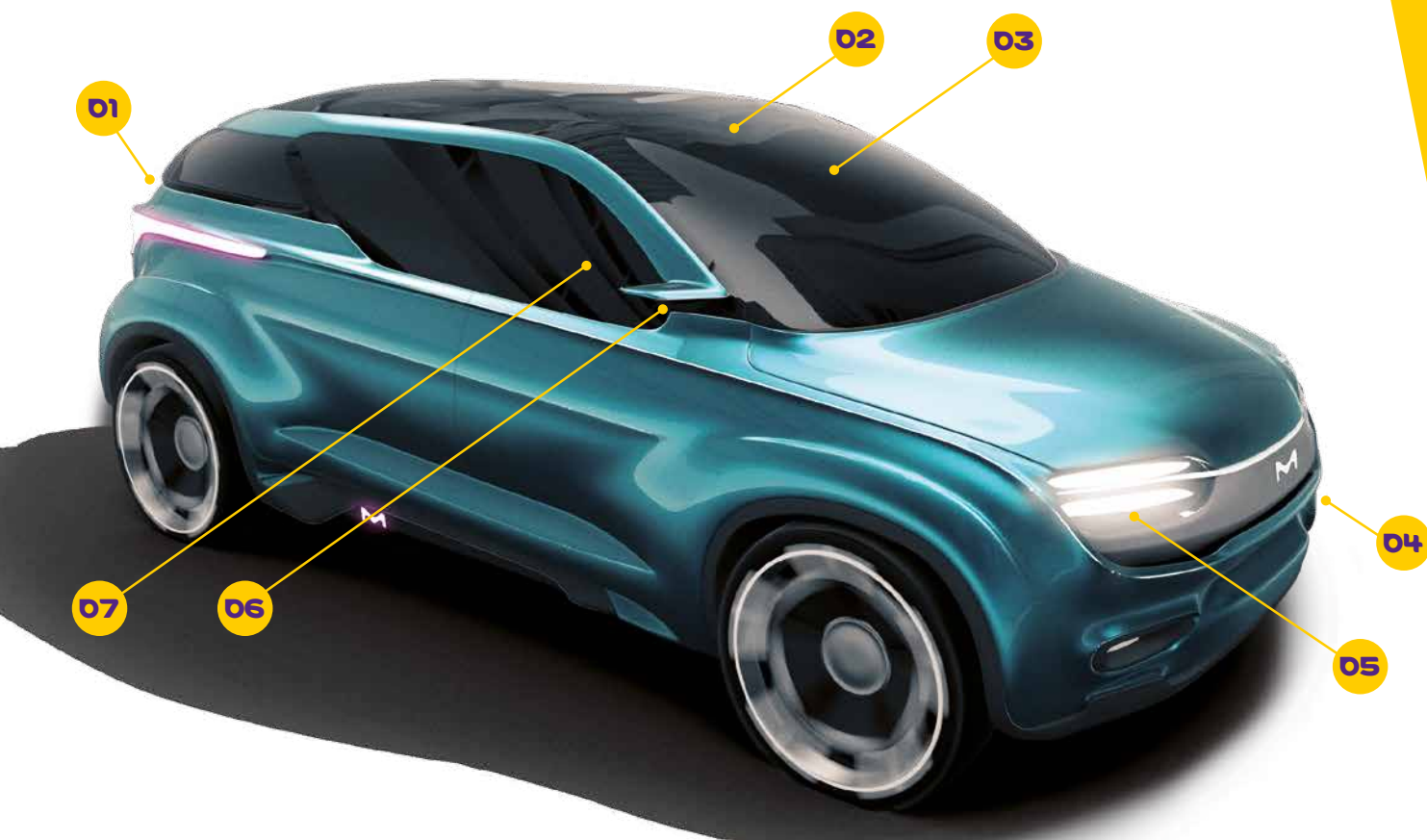
Helping prevent over one thousand injuries per year, rear view cameras are required by law in the United States. Top ratings in the NCAP crash test require front cameras. Millions of camera systems are to be installed to meet these requirements.

The EMD Patinal® portfolio provides you with the highest quality coating materials for your camera optics. As the demands for quality and reliability of car optics increase, you can rely on an established material supplier with proven expertise and experience.



Patinal® COATINGS

for automotive applications



- 01** Rear view camera
- 02** Multi camera input
 - Autonomous parking assistant
 - Surround view camera
 - Night vision camera
- 03** Front & side window coatings
- 04** Front & split view camera
- 05** Coatings for lighting systems (e.g. LED optics)
- 06** Mirror coatings & video based rear view mirror
- 07** Interior applications
 - Driver monitoring camera
 - Head up display
 - Dashboard coating

Patinal® MATERIALS

for safety-relevant camera optics

- Our portfolio includes over 40 materials for optical thin films
- Whole range of low, medium and high refractive index materials
- High density and crystalline materials
- Wide transparency range



for lighting systems

- LED and laser headlights revolutionize traffic safety
- Illumination is essential for autonomous driving by night
- Patinal® coatings provide optical functionality on polymers for a car's lifetime

EMD is your reliable partner for PVD coating materials that last and provide functionality over the lifetime of a car.

For detailed information please visit: www.patinal.com

Patinal® MATERIALS

for car mirrors

- Durable and scratch-resistant layers
- Clear rear view over car's lifetime
- Robust and scratch-resistant layers that last through all kinds of weather conditions



for exterior car cameras

- AR coatings for all lenses to ensure high light throughput, distortion and flare-free imaging
- Coating materials for night vision applications
- Water- and smudge-repellant top coating



oxide mixtures

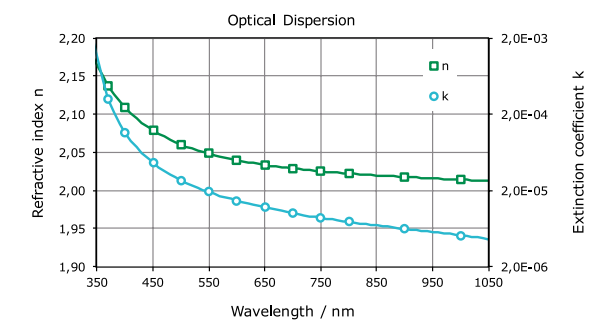
FOR COATINGS ON POLYMERS

A range of oxide mixtures optimized for coatings on polymer substrates provides reliable deposition processes even on cold substrates. Good adhesion and film stress adjustment provide high durability of the optical thin film.

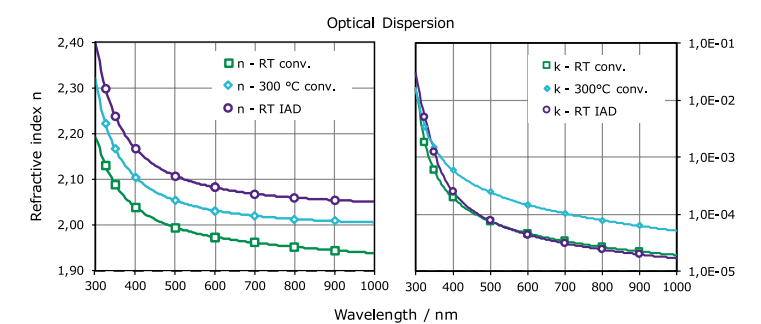
High-index materials

- Highly reproducible processing resulting in stable, homogeneous and absorption-free thin films
- Many materials such as substance H4 or Ta_2O_5 have a proven track record in the optics industry
- Our substance H8 provides low thermal substrate load and excellent UV-blocking

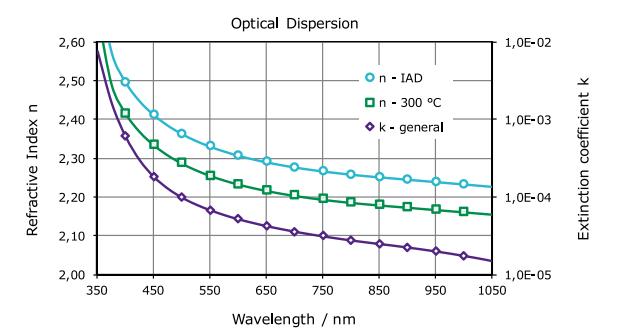
Substance H1 Patinal®



Substance H4 Patinal®



Substance H8 Patinal®



Our Tech Support team can help you with guidance on product choices and layer properties.

oxide Mixtures

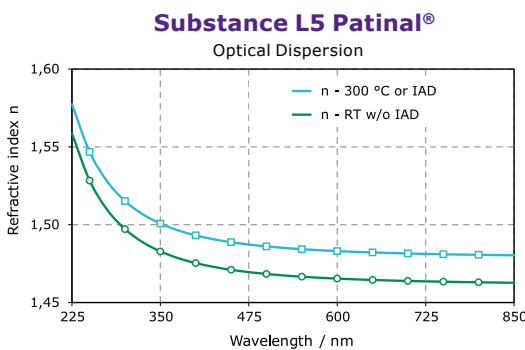
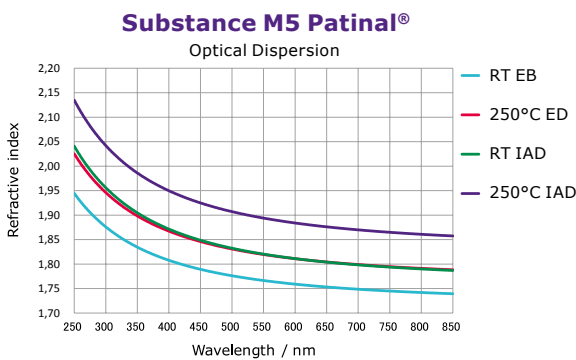
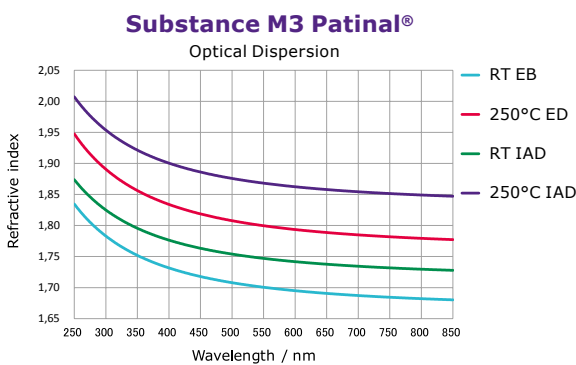
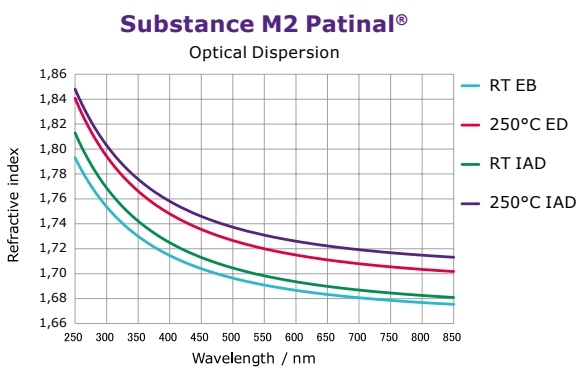
FOR COATINGS ON POLYMERS

Medium-index materials

- Have a refractive index between 1.7 and 1.8 at 550nm with a wide transparency range and easy processability
- Show no sublimation and possess higher environmental durability compared to Al_2O_3 , Y_2O_3 and MgO
- Increase the process yield, improved thickness distribution
- Form dense, homogeneous and shift-free films over a wide temperature range
- Provide a stable evaporation process without shift in composition
- Easy incorporation in designs for AR coatings, polarizers and beam splitters
- Offer additional degrees of freedom for coating designs and processes

Low-index materials

- Substance L5 Patinal® is a low refractive index mixture of SiO_2 and Al_2O_3
- Coatings made with L5 Patinal® show increased density and improved stability to damp heat
- Very durable and highly transparent coatings on polymers
- Can replace SiO_2 in coating designs and thereby improve performance



the overcoat for challenging requirements

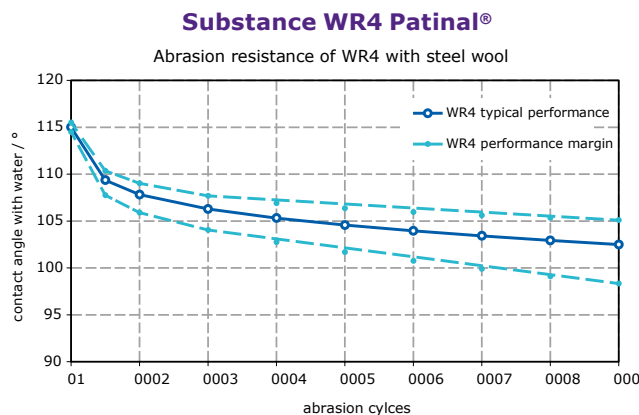
Patinal® SUBSTRATE WR4 FOR CAR CAMERAS

- Ensure the functionality of the optical assembly with a top layer that is water-, smudge- and oil-resistant
- Very good adhesion properties on SiO_2
- High robustness and durability
- Deposition process compatible with the layers underneath
- Ideally suited as the top layer on any outside car camera

Property	WR4 Patinal®
Contact angle (water)	116°
Contact angle hysteresis (water) ($\theta_a - \theta_r$)	12°
Sliding angle (water)	30°
Abrasion resistance	Very good

Exterior cameras are exposed to various environmental conditions and need to provide clear vision even in bad weather conditions such as rain or snow.

Especially for autonomous driving, the image cannot be blurred in order to prevent misinterpretations of dust or rain as obstacles. A durable smudge-resistant coating is thus an essential part of any ADAS camera system.





the quality choice in evaporation Materials

- Whole range of low-, medium- and high-refractive index materials available
- Suitable for vapor deposition onto glass and polymer substrates
- Patinal® materials from EMD show high durability and enduring functionality, no replacement of a car camera due to deterioration of the optical coatings necessary
- Long-term, global material availability and batch-to-batch-reproducibility that ensures a standardized mass production of a car camera system
- Superior optical performance
- WR4 used as hydrophobic overcoat for car cameras, compatible with all other AR-coating processes
- Proven usability in the demanding fields of automotive applications



your reliable partner

- Merck KGaA, Darmstadt Germany is a globally renowned company with 350 years of experience
- Patinal® has been a globally established brand for high-quality optical materials for over 30 years
- Patinal® production and sales comply with ISO 9001 and 14001 management systems
- All our materials are tested internally at EMD according to the highest quality standards
- Long-term portfolio stability with batch traceability; global availability
- As a global chemical company, all required documents can be provided (e.g. MSDS, RoHS, non-conflict, ...)
- RoHS compliance is verified for each batch and is part of the CoA
- Since you don't have to worry about the material, you can focus on the added value of your optical system and reduce overall costs

EXCELLENCE STARTS WITH US

