RheoLight™
Crystal Glass Pigments

CRYSTAL GLASS PIGMENTS FOR A BRILLIANT, BEAUTIFUL AND SAFER WORLD

INK INVENT
SUSTAINABLE SOLUTIONS

EDITORIAL

RheoLight as world's first 1-10 micron size Crystal Glass Pigments, are specifically designed for the automotive industry. RheoLight enhances visual visibility and sensor detection of vehicles for Advanced Driver Assistance Systems (ADAS). Hereby RheoLight sets the new safety standard for exterior design in the mobility industry.

RheoLight Crystal Glass Pigments refract light in a unique way not found in any other product on the market. This is due to its distinctive physical, chemical, and morphological properties. A masterpiece in optical brilliance, like diamonds they refract light with ever changing reflections. A true breakthrough in color styling with attractive color shifts and fascinating light effects.

Jacques Arthur Knoote
Director Innovation

# COLOR IN A NEW LIGHT

CONTENTS

RHEOLIGHT ART EXHIBITION

"Color in a New Light" is an extraordinary showcase at the intersection of art, innovation, and safety. The exhibition unveils the compelling story of RheoLight, the world's first Crystal Glass Pigments specially produced for the industrial coating industry. Through seven exhibits, we delve into the transformative effect of RheoLight, where every color shade plays a role in redefining the future of mobility.
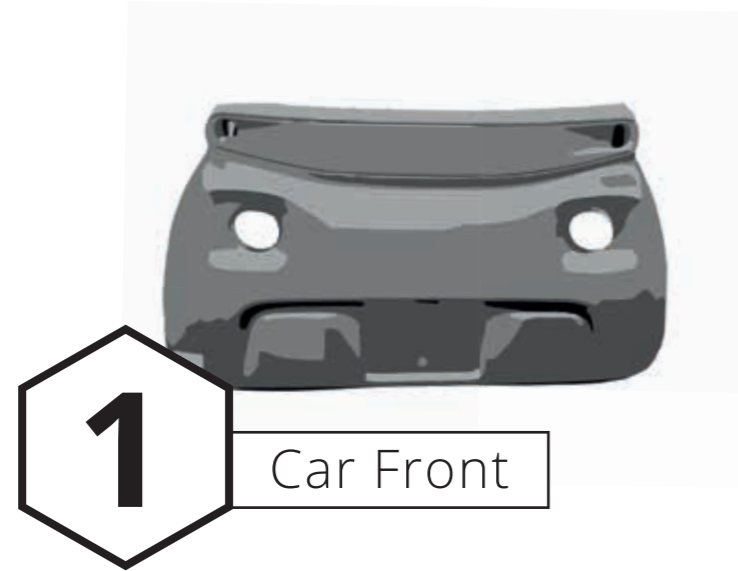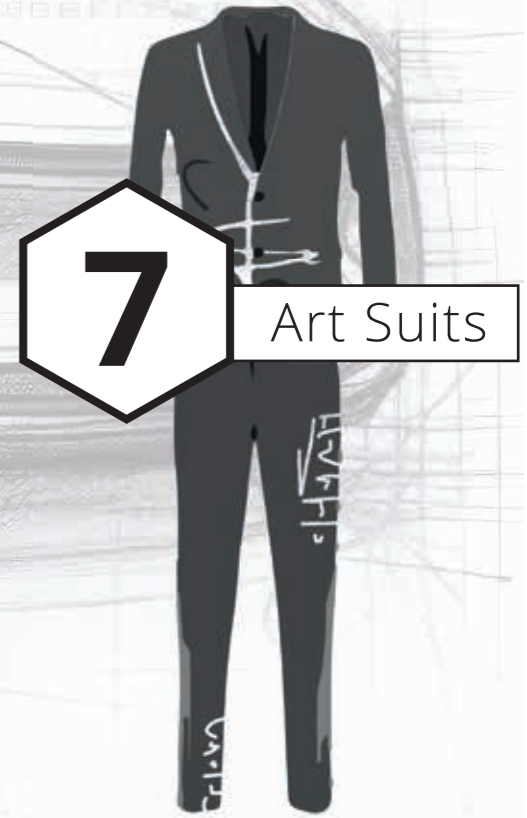
2 Live LiDAR
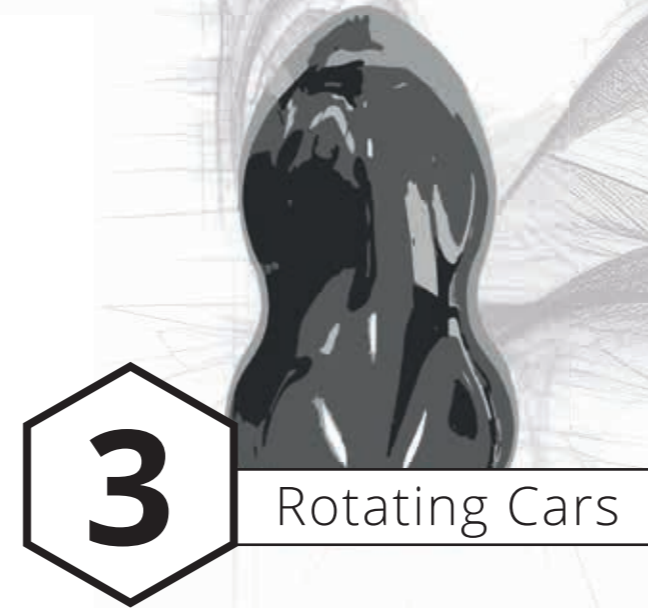
4 Helmet

5 Car Models

1 Car Front

3 Rotating Cars

6 Petrol Tank

7 Art Suits

LIGHTEN UP YOUR COLOR

With "Transitional Lapiz Lazuli", the artist orchestrates striking transformations within a singular color spectrum, revealing softened hues and nuanced shades. The artwork showcases playful color shifts and encapsulates a contemporary, elegant, and futuristic aesthetic. Seamlessly integrating functional safety elements necessary for the era of autonomous driving.

Artist Menno Knoote, December 2023
Title Transitional Lapiz Lazuli
Exhibit Car front on concrete 160 cm x 110 cm
Owner RheoLight ColorLab Academy

COLOR TREND 2025 FUNCTIONAL AND CAPTIVATING

2 Live LiDAR

INVISIBLE VISIBILITY

Some dark colors are hardly detectable by current ADAS autonomous driving sensors and are a serious risk in traffic safety. Now, it is possible to make previously invisible objects visible. By adding a low concentration of RheoLight to invisible (dark) colors they become visible and detectable for ADAS.

Artist Team RheoLight
Title Live LiDAR
Exhibit LiDAR scanner
Owner RheoLight ColorLab Academy

NOW ADAS, LiDAR AND AI CAN DETECT YOU!

Extensive LiDAR system field tests have shown that 1-3% of RheoLight improves LiDAR detectability significantly. The original color stays intact and there is no visual high reflectivity effect. Improved LiDAR, ADAS and AI algorithm responses ultimately result in a safer traffic environment and contribute to the progression of reaching next SEA levels of autonomous driving.

2 Live LiDAR

ULTIMATE SAFETY
IN MOBILITY

By day and night every color becomes less visible under increasing angles of observation. In traffic, where safety is driven by visibility and detectability, not being seen is dangerous. RheoLight as Tunable Detection & Determination Technology provides an effective safety factor for creating beautiful, higly visible colors for the mobility industry.

The striping applied on the car shows a standard dark grey metallic automotive color. The mini striping in the middle is tuned by adding 3% RheoLight to the color formula. The outer sides of the bodywork contains 20% RheoLight. Self-driving sensors detection reliability improves with 100 up to 200%! The image shows the visual effect lighted by car headlights, under ambient daylight the color is dark grey.
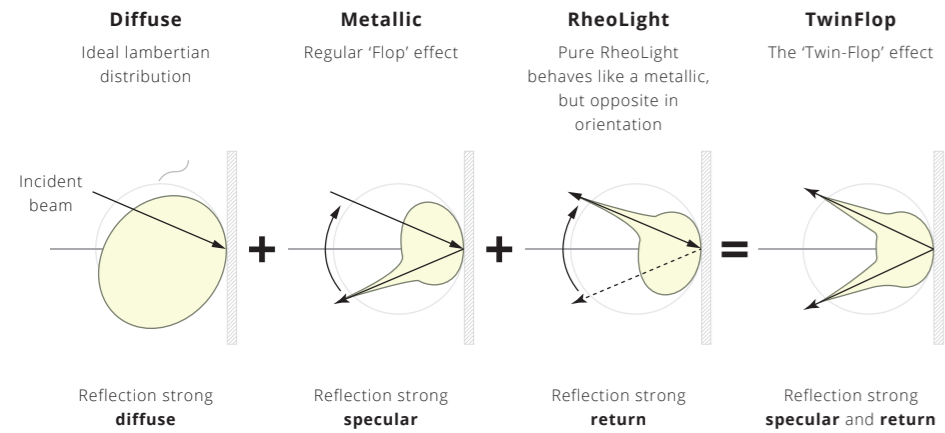

SAFETY MADE
BEAUTIFUL

2 | Live LiDAR

TWIN FLOP INCREASES VISIBILITY

RheoLight Crystal Glass Pigments change the direction and reflection of light, creating a unique Twin Flop effect with a strong specular and return reflection in every light condition.

This improves Angular Independent Point of View Visibility (AIPOV), making objects more visible to the human eye and detectable for autonomous driving LiDAR systems, computer technologies, and AI.

Diffuse	Metallic	RheoLight	TwinFlop
Ideal lambertian distribution	Regular 'Flop' effect	Pure RheoLight behaves like a metallic, but opposite in orientation	The 'Twin-Flop' effect

Incident beam

| Reflection strong **diffuse** | Reflection strong **specular** | Reflection strong **return** | Reflection strong **specular** and **return** |

SHAPING THE FUTURE OF MOBILITY

2 Live LiDAR

VISUAL VISIBILITY BOOST

The percentage RheoLight implemented in color formulations control the visual reflection by day and night. The Vespa scooter on the right has RheoLight added to the original grey metallic color. In daylight the color is similar as the Vespa scooter without RheoLight (left).

At night, activated by car headlights, Rheolight's billion Crystal Glass Microsphere Pigments maximize both human eye and sensor visibility. LiDAR detection results goes up 140 times and Computer Vision reliability increases with 21%. This is an additional benefit for the accuracy of AI making the right decisions in autonomous driving systems.
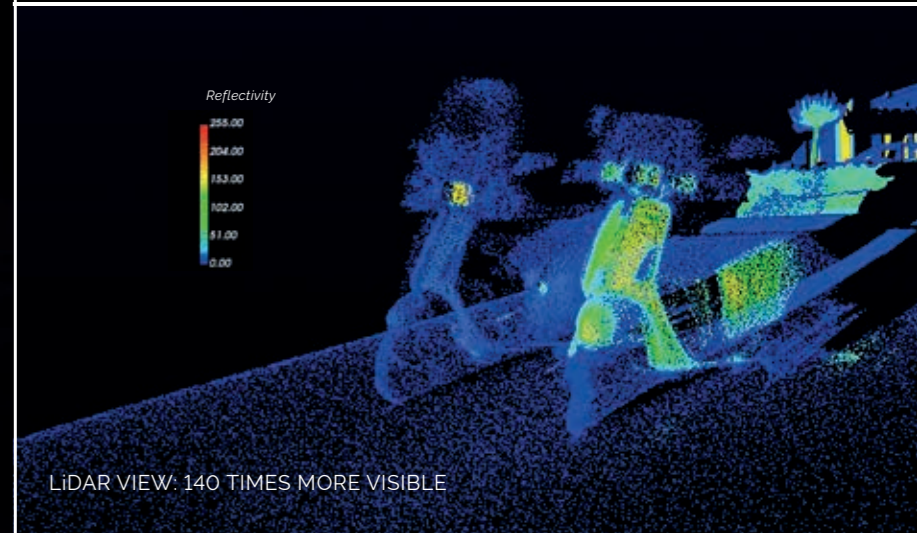
TO BE SEEN
SAVES LIVES

DAYTIME: SAME COLOR
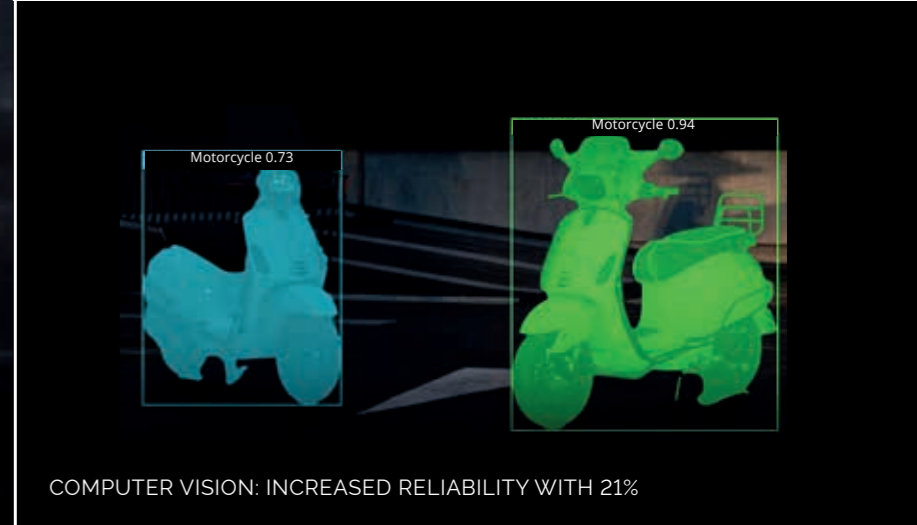
COMPUTER VISION: INCREASED RELIABILITY WITH 21%

LiDAR VIEW: 140 TIMES MORE VISIBLE

3 Rotating Cars

IT'S ALL ABOUT COLOR

In our philosophy, we embrace color as a powerful manifestation of both creativity and functionality. RheoLight Crystal Glass Pigments engage in a fascinating dialogue with every variant of effect pigment, allowing color designers and formulators to create truly unique and purposeful color shades.

Using as little as 1% of RheoLight in a pearlescent or metallic color, you can instantly change the light reflection angle. This unique feature creates the Twin Flop effect, which is an exciting subtle interplay of color, shape and light reflections. If you want to enhance both the visual appeal and the visibility for self-driving sensors (ADAS) you can add 10 to 20% RheoLight to the color formulation. This will result in unparalleled sensory impact and maximum visual visibility at night. With 1 till 5% RheoLight you can make 'invisible' colors detectable for the self driving sensors.

Artist   Jacques Arthur Knoote, November 2023
Title   Everybody can be an artist
Exhibit   Car models on concrete 80 cm x 50 cm
Owner   RheoLight ColorLab Academy

IMPECCABLE OPTICS

Being visible in traffic is especially valuable for Vulnerable Road Users (VRU's) such as bicycles, scooters, motorbikes, etc. Traffic safety and emergency response vehicles (e.g. ambulances, police, firefighters, tow trucks etc.) can also benefit from being more visible. The bicycles in action at night shows the exceptional visibility difference of a dark grey metallic and orange color without and with RheoLight inside.

3 | Rotating Cars

EURO YELLOW RAL 1016 REMASTERED

The color of reflective markings used on ambulances is crucial for their effectiveness. According to research, the human eye responds best to the color Euro Yellow (RAL 1016). Therefore, this color is used on ambulances and other emergency vehicles throughout the European Union.

The engineers at RheoLight ColorLab Academy undertook the challenge of enhancing the visibility of Euro Yellow (RAL 1016) at night and improving the detection of autonomous driving (ADAS) systems. After conducting thorough research and development, they were able to create a distinctive color formula that significantly increases both the visibility for human eyes in low-light conditions and the LiDAR detectability.

Comparison of Euro Yellow (RAL 1016) and remastered version with 20% RheoLight. Measurements were taken from five viewing angles under civil twilight (3.2 Lux) and car headlights (100 Lux). The visual and LiDAR increase of the remastered formula is defined in percentages.

Visual visibility improved with 116% till 137%
LiDAR detectability improved with 115%

1   2   3
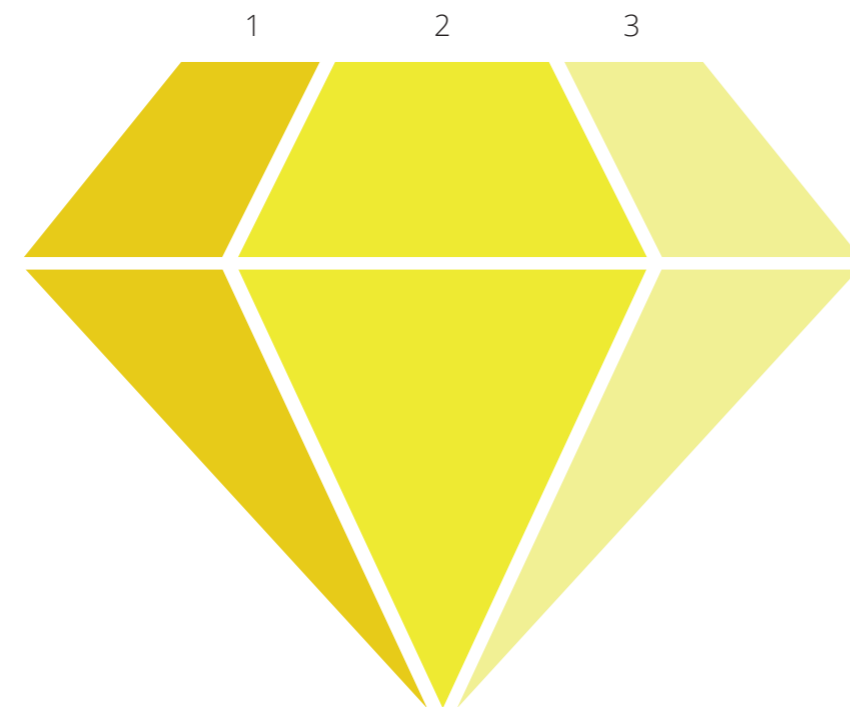
1. Euro Yellow RAL 1016 - Civil twilight 3.2 Lux
2. Remastered - Civil twilight 3.2 Lux; visual +137% / LiDAR +115%
3. Remastered - Night 100 Lux; visual +116% / LiDAR +115%

SAFER YELLOW

4 | Helmet

EVERY SHADE
OF GREY

Artist Objective; optical elegance by day, and maximum visual and ADAS sensor visibility at night. Harley Davidson Night Rod Custom. Smokey metallic grey for the body and helmet. The original color tuned with 21% RheoLight and 1% pearlescent blue effect pigment. Compared with the original color formula, the human eye visibility by car headlights improved with 350%, and LiDAR detectability score with 400%.

Artist   Menno Knoote, July 2023
Title   Remastered cruiser
Exhibit   Helmet on concrete 45 cm x 40 cm
Owner   Rik Wieringa

NIGHTTIME SAFETY

4 Helmet

UTCH ROYAL ORANGE

The artist objective was to achieve a visually appealing design during the day while ensuring maximum visibility for the human eye at night and ADAS sensors. The focus is on balancing aesthetics and functionality, making it an ideal and safe solution for any modern vehicle.

The Yamaha Dragster 650 Classic has now a stunning , sporty new look with its pearlescent orange and titanium silver automotive color shades that have been expertly remastered. To add an extra touch of brilliance, 20% RheoLight has been added to the mix, resulting in an eye-catching finish that is sure to turn heads.

Artist   Menno Knoote, June 2022
Title   Dutch royalty orange
Exhibit   Helmet on concrete 45 cm x 40 cm
Owner   Jacques Arthur Knoote

CLASSIC BEAUTY

ENCHANTING COLORS

"Color Harmony" is an art display showcasing abstract car models on a concrete surface. The artwork's unique form and color choice goes beyond traditional car design, inviting viewers to reflect on the interplay between shape, color and the essence of mobility. The reflective surfaces give the impression that the shapes are not static objects but rather embodiments of the ever-changing nature of mobility.

The artwork features a radiant palette of bright, high-gloss colors that convey a dynamic and cheerful mood. The RheoLight color shifts adding 5 and 20% RheoLight to the original color shade brings depth and visual clarity making it easier for both humans and machines to perceive the object.

Artist   Menno Knoote, November 2023
Title   Color Harmony
Exhibit   Car models on concrete 160 cm x 110 cm
Owner   RheoLight ColorLab Academy

10 AUTOMOTIVE TREND COLORS REMASTERED
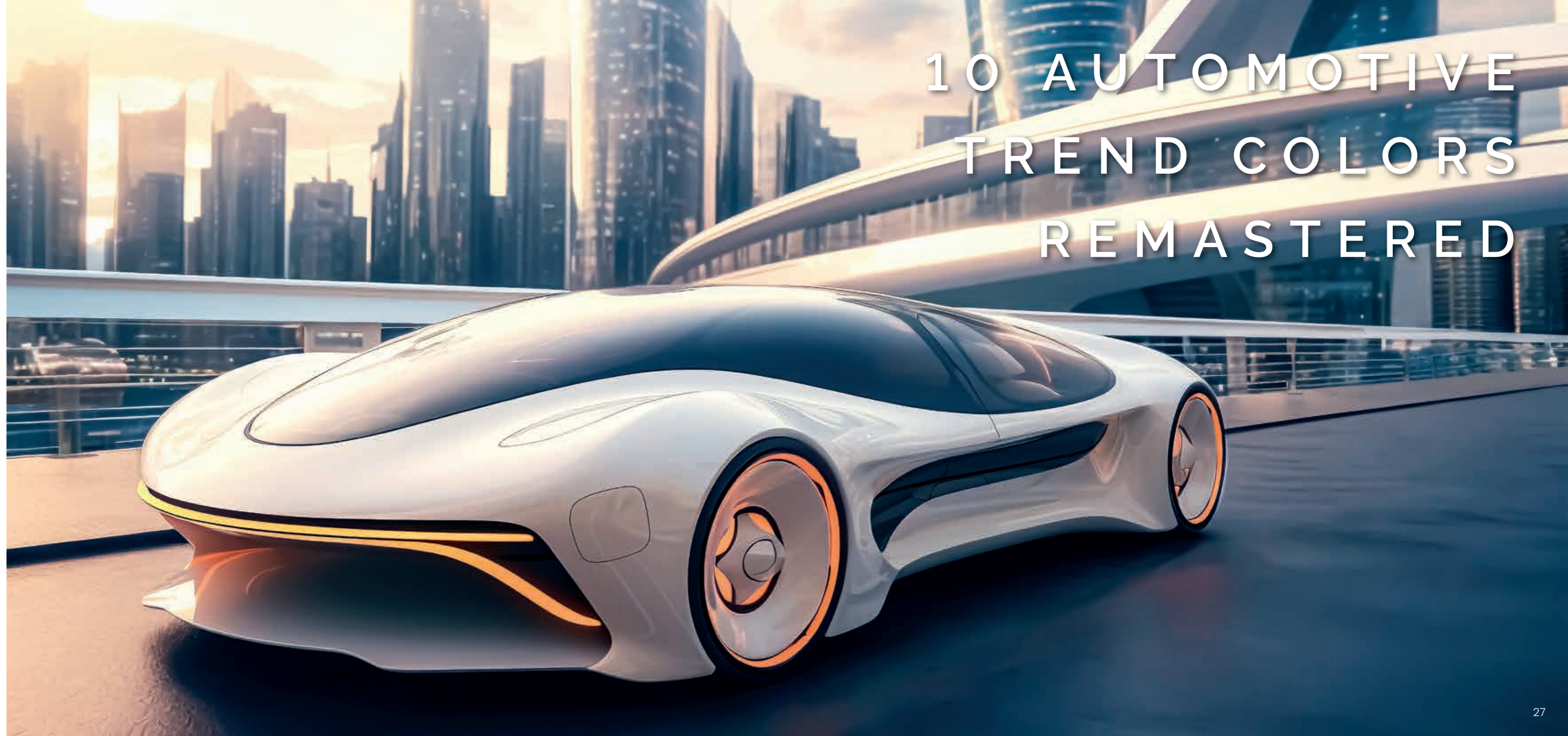
5 | Car Models

## WORLD'S WHITEST AND BRIGHTEST WHITE

White is often considered the safest color due to its ability to reflect almost all incident energy throughout the visible spectrum. However, when viewing white cars at night, they appear grey, which make them less visible.

The RheoLight ColorLab Academy engineers have created a special formula remastering Signal White (RAL 9003) that enhances visibility in low light conditions and improves the performance of autonomous driving assistance (ADAS) systems.

Enhanced visibility contributes significantly to better object detection, determination, and accident prevention, providing a strong and powerful presence for law enforcement and emergency response vehicles.

Comparison of Signal White (RAL 9003) and remastered version with 20% RheoLight. Measurements were taken from five viewing angles under civil twilight (3.2 Lux) and car headlights (100 Lux). The visual and LiDAR increase of the remastered formula is defined in percentages.

Visual visibility improved with 148% till 233%
LiDAR detectability improved with 121%

1   2   3
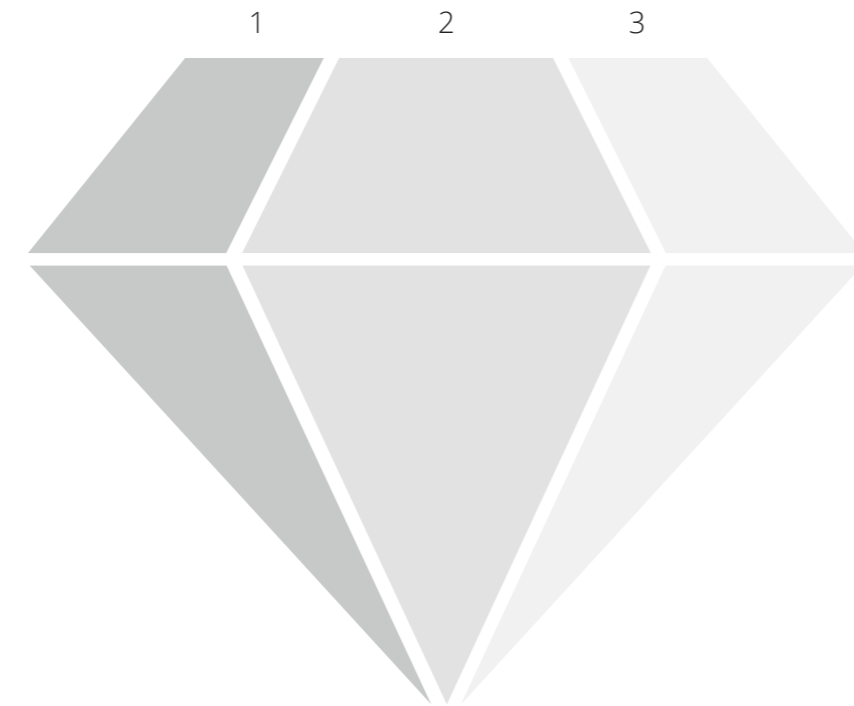
1. Signal White RAL 9003 - Civil twilight 3.2 Lux
2. Remastered - Civil twilight 3.2 Lux; visual +233% / LiDAR +121%
3. Remastered - Night 100 Lux; visual +148% / LiDAR +121%

EXCEPTIONAL WHITE

5 Car Models

MCLAREN 720S

RheoLight refracts light differently than any existing effect pigment on the market. Brilliant colors and ever-changing highlights accentuate elegance and style.

Astonishing RheoLight custom color formulation and paint job. The magic recipe. First color layer is a black metallic base coat with RheoLight. The second color layer is a semi-transparent pearlescent red chameleon. Finally a gloss clear coat. RheoLight in the first color layer intensifies the chameleon color variations under different viewing angles.

Artist   Justin Pollington, August 2022
Title   It's Just Magic
Exhibit   Car models on concrete 80 cm x 50 cm
Owner   Claritycoat England

NO LIMITS COLOR EFFECTS

6 Petrol Tank

TUNABLE COLOR REFLECTION

"Blue Devil" is an exciting journey that takes viewers through the streets at night, showcasing the dynamic allure of a RheoLight scooter at different times of the day. The colors are a masterful combination of movement and stillness, with a commanding presence of deep blue amplified by the mysterious darkness of the night.

Jorik Koopman, the creator of "Blue Devil," not only formulated the scooter color, but breathes life into it, turning it into a symbolic representation of speed, elegance and the rebellious spirit of the urban night. He captures the raw energy of urban mobility and the intricate details making the scooter a symbolic "blue devil" on the streets.

Artist   Jorik Koopman, December 2023
Title   Blue Devil
Exhibit   Petrol Tank on concrete 48 cm x 40 cm
Owner   Koopman Lakken

At night in car headlights Light blue

Bright blue at sunset

BRILLIANT COLOR SHIFTS

Navy blue in ambient light

7 Art Suits

NO LIMITS CREATIVITY

RakeStreken is an artistic collaboration between Sanne Knoester and Paul Boswijk based in The Netherlands. Since 2012, they have combined their unique styles - Sanne's graphic arts expertise and Paul's visual arts proficiency.

Their artistic journey has been characterised by continuous evolution, from initial sketches in notebooks to intricate sketches on canvas and murals. After securing a dedicated studio, they ventured into lifestyle design creating cohesive, visually pleasing artwork across multiple design and media disciplines.

Artists Objective; Transform business suits into works of art by skilfully applying fashionable calligraphy artwork using six RheoLight textile ink color shades.

Artist   Sanne Knoester, Paul Boswijk, December 2023
Title   Dress to Impress
Exhibit   Suits RheoLight Management
Owner   RheoLight ColorLab Academy

ONE OF A KIND

NOVEL
COLOR DESIGN

After years of research, our chemists and engineers developed the impossible, world's first 1-10 micron Crystal Glass Pigments with a average particle size of 5 micron. Like diamonds they refract light with ever changing reflections opening a new world of color shades for designers in every industry.

RHEOLIGHT CSTL SPECIFICATIONS

Particle size	1-10 micron
Particles in size range	> 99%
Optical properties	Isotropic
Color	Colorless
Luster	Adamantine
Diaphaneity	Transparent
Density	1.9 g/cc ± 0.3 g/cc
Refractive index	2.1
Melting point	> 1.200°C

HOW SMALL IT CAN BE?

Almost not imaginable, 1 gram RheoLight contains 12 billion perfectly round Crystal Glass Microspheres with an average particle size of 5 microns! A bicycle frame needs about 50 gram, 600 billion microspheres in the color formulation to be very visible in the dark and optimal detectable by ADAS sensors. To boost ADAS sensors detection of a dark color sedan, 100 gram, 1.2 trillion microspheres is adequate.

PLATFORM TECHNOLOGY

RheoLight is developed as a universal, patent protected, platform technology. As a result, it fits seamlessly in existing coating, ink, paint and plastic formulations, and is compatible with every industrial application process. RheoLight is available in water- and solvent based dispersions and plastic mono concentrates. Easy to incorporate in any formulation to create amazing living colors with dynamic light effects.

APPLICATIONS

Automotive coatings

Industrial coatings

Textile and printing inks

Leather & synthetic leather coatings

Interior design paints

Art & creative inks & paints

Plastic master batch & compounds

ABOUT INK INVENT

Ink Invent BV, a privately-owned company in the Netherlands, proudly presenting RheoLight, a strategic innovation in effect pigments specifically designed for the mobility and automotive industry. Founded in 2018 by passionate engineers and entrepreneurs. With an extensive global patent portfolio we are redefining color functionality enabling enhanced visibility and detection of all traffic participants, ultimately contributing to a safer traffic environment.

AWARDS

Ink Invent is honoured to announce that their product, RheoLight has been named a CES® 2024 Innovation Awards Honoree in the category 'Smart Cities' as a recognition for the outstanding design and engineering features.

"Smart colors: RheoLight sets the bike frame aglow. The pigments are compatible with water-based and conventional paints and can be applied in the usual way. When it's dark, the tubes light up – no matter the frame's color."

"The jury was unanimous in its opinion that your entry belongs to the frontrunners within the Dutch Automotive sector and is therefore pleased to nominate it for the Automotive Innovation Award 2021."

"According to the jury, this innovation clearly contributes to increasing the safety of cyclists in traffic. The jury is very impressed that the bicycle lights up so well. The additive is very unique and certainly promotes safety on the road."

COLOFON

PRESS
DOWNLOADS

INKINVENT.COM/PRESS

INK INVENT™
RheoLight™ Crystal Glass Pigments