May 2020

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Introduction to Vantablack® Absorber Coatings Used In Automotive Stray Light Suppression

VANTABLACK

Where Vision Makes the Difference

ENHANCING: SPACE INSTRUMENTS – AUTOMOTIVE SAFETY – DSLR LENSES – UXHD DISPLAY TECHNOLOGY

Surrey NanoSystems Background

- Established 2007, East Sussex, UK
- Venture Capital backed, with access to strong financial resources
- Patented technology in sprayed super-black coatings
- Launched Vantablack® branded range of spray super-black coatings 2016, first HUD and LiDAR integration in 2018
- Rapid expansion, with new Production facilities providing Coating-as-a-Service (CaaS) to Automotive sector
- R&D Facility for training and product development
- Strong scientific team: PhDs, MChem and MPhys qualified research scientists to help address customer challenges

US Representative:

Santa Barbara Infrared, Inc.
Suit D
30 S. Calle Cesar Chavez,
Santa Barbara, CA. 93103

UK R&D centre:

Building 24,
Euro Business Park
Newhaven, East Sussex
BN9 0DQ

UK Production:

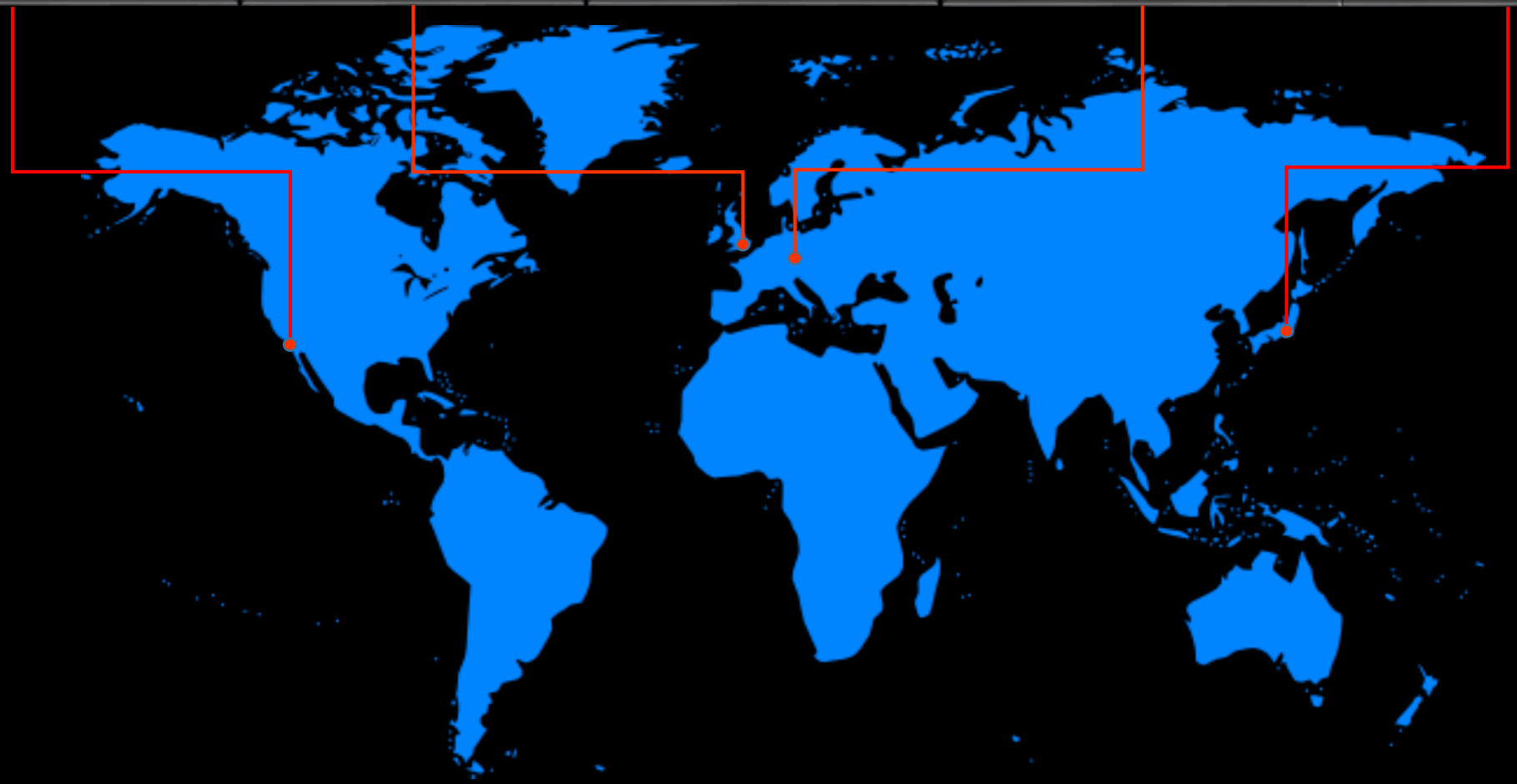
East Side Business Park
Beach Road, Newhaven
East Sussex
BN9 0FB

Germany Sales Office:

Automotive Coatings
Frankfurt am Main
Germany
+49 151 22919105

Japan Representative:

Ocean Photonics, Inc.
Nishi Waseda 3-30-16,
Shinjuku-ku,
Tokyo 169-0051



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SNS Facilities and Global Representatives

Surrey NanoSystems Automotive Coatings Business Model

Coating as a Service

- Customer parts are shipped to our UK production facility, coated to customer specification and then returned for integration.
- Some integration is possible in our UK facilities.
- Bulk shipping costs, import costs and tariffs need to be taken into account when temporarily importing parts for coating

Technology Transfer

- Applies to Vantablack S-VIS
- Where volumes are high then it is possible to licence the technology for use in your production facility

VBx2 Bulk Supply

- VBx2 is a paint like coating that that customers are able to purchase in bulk for application in their facilities.
- The coating uses conventional spray gun technology so capital investment is low.
- Technical training is required to enable customers to successfully set up coating lines as the spraying techniques are different to conventional paints

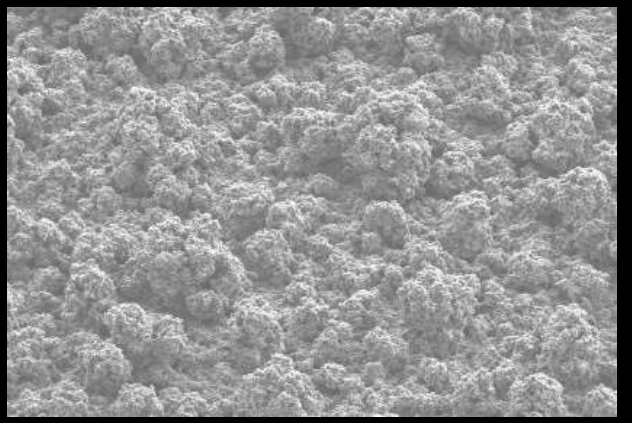
Automotive Coating Range

- S-VIS: HUD Systems, Exterior Lighting and LiDAR
- VBx2: Camera Shields, Exterior Lighting and HUD systems

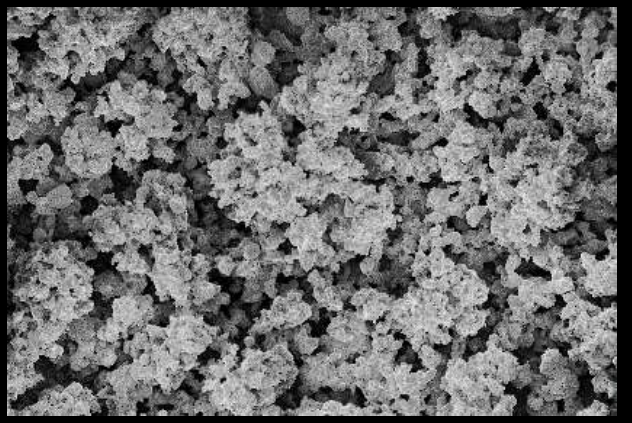
A unique, complementary super-black automotive product portfolio

- **Vantablack S-VIS –** spray-applied wide area coating, exceptional performance across the spectrum from UV-FIR – used for critical stray light control (coated parts require vacuum post spray processing so maximum part size is 650mm x 450mm x 150mm)
  - Head Up Displays
  - LiDAR
  - Exterior Lighting
  - THR (Total hemispherical Reflectance) – 0.2%

- **Vantablack VBx2 –** Conventional spray application, no scale limitations, used for stray light control in automotive camera shielding, exterior lighting systems , architecture and aesthetic applications
  - Camera Shields
  - Head Up Displays
  - Exterior Lighting
  - THR (Total hemispherical Reflectance) – 1%



Vantablack S-VIS



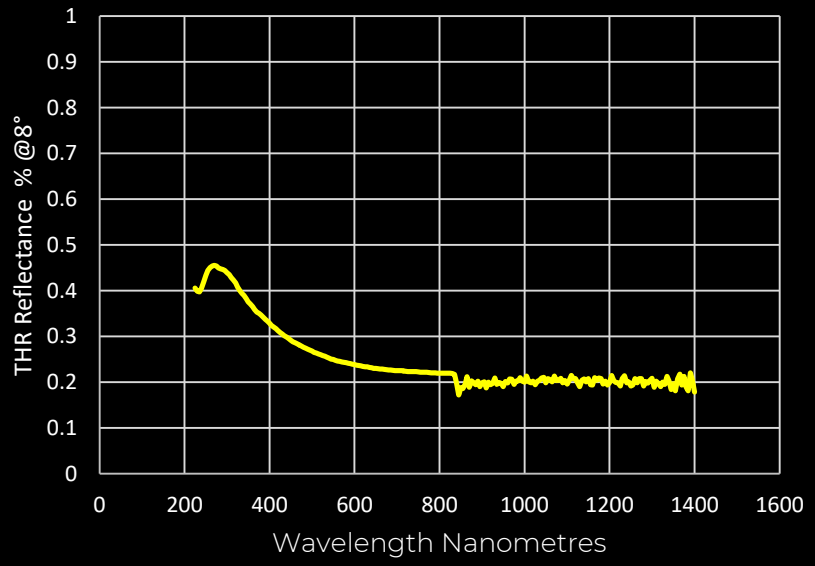
Vantablack VBx2

SEM Micrograph Images

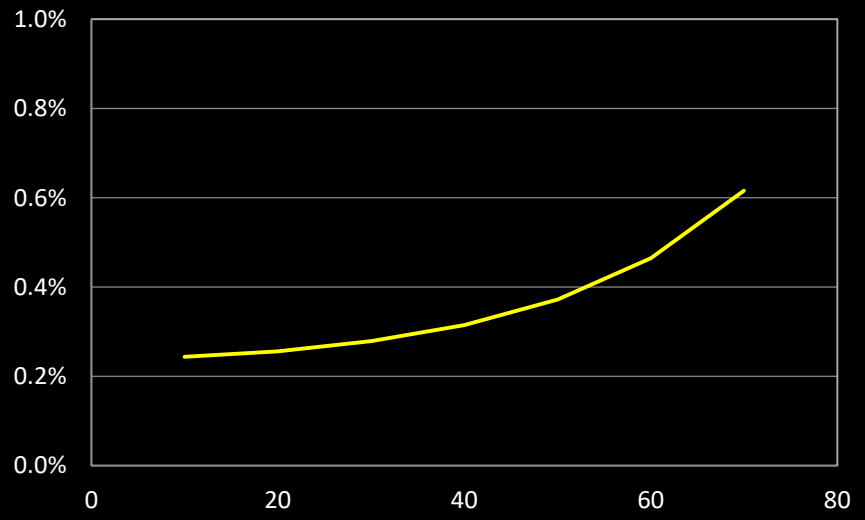
Not Just Another Black Coating

- Vantablack S-VIS provides exceptional performance in ADAS applications because of it's very high level of absorption. Uniquely and unlike other paints and flocks, it retains this performance from almost all viewing angles
- This means light hitting the absorber surface from any angle is efficiently captured and unable to interfere with critical elements within the electro optical assembly
- This is not the case with conventional paints and flocks where sunlight frequently blinds the sensor or produces significant artefacts

Vantablack S-VIS: Absorption



Change in absorption vs AOI - 400nm – 800nm



Video Clip demonstrating sunlight grazing angle performance

Nextel 81121 – Flocking – Vantablack S-VIS

Improving Driver Safety In Automotive Applications

- Head Up Displays
- Camera Glare Shields
- Headlamps
- Tail Lights
- LiDAR Sensors

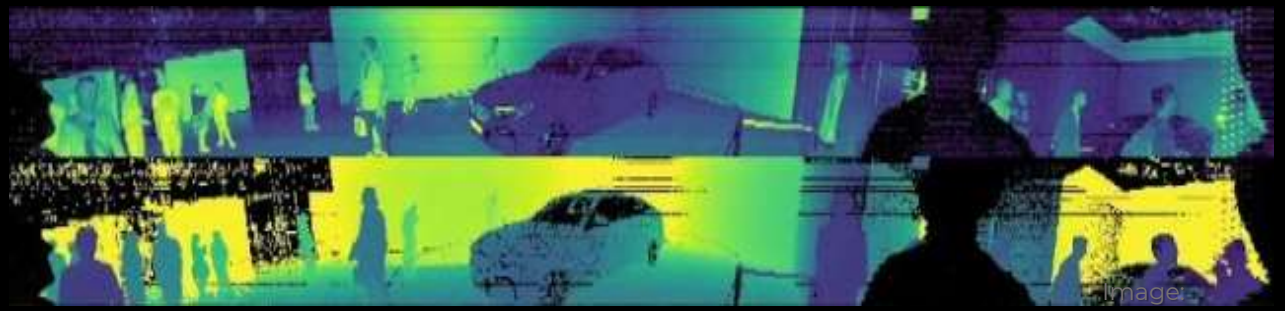


Image:
ouster.io

Head Up Displays

- Significant improvement in window ghosting artefacts
- Improved contrast ratio for next generation optics
- Removal of complex baffle foam and flocking processes
- Solves adhesion issues found with conventional paints on certain substrate types

Existing coatings allow distracting sunlight artefacts in the drivers line of sight

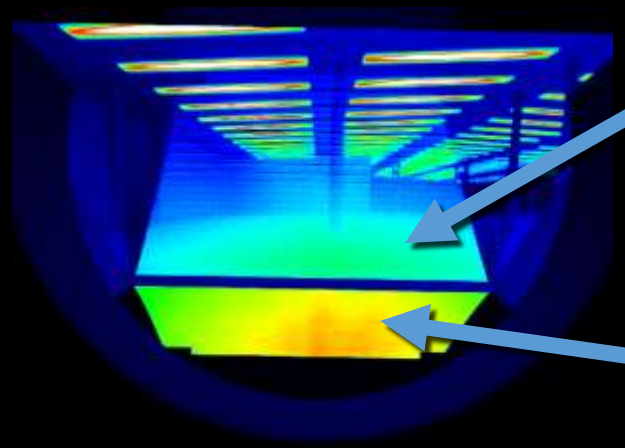
First Vantablack HUD – artefact free

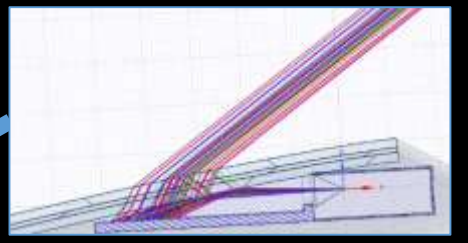
Elimination of stray light using Vantablack S-VIS © ANSYS OPTIS

Data Courtesy of ANSYS OPTIS https://marketing.optis-world.com/acton/fs/blocks/showLandingPage/a/17674/p/p-012a/t/page/fm/0

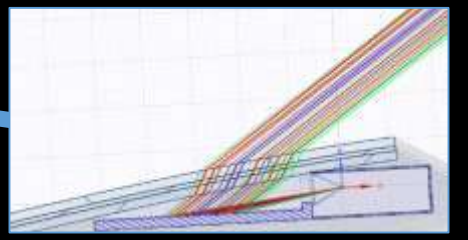
ADAS Camera Glare Shields

- Ghosting and overexposure can be virtually removed
- Veiling glare drastically reduced
- Baffle structures can be eliminated, simplifying manufacturing processes
- High contrast sunlight or night driving glare reduction





Reflection on the windshield



Direct sun reflection on prisms

Standard Automotive black paint

Vantablack S-VIS coated glare shield

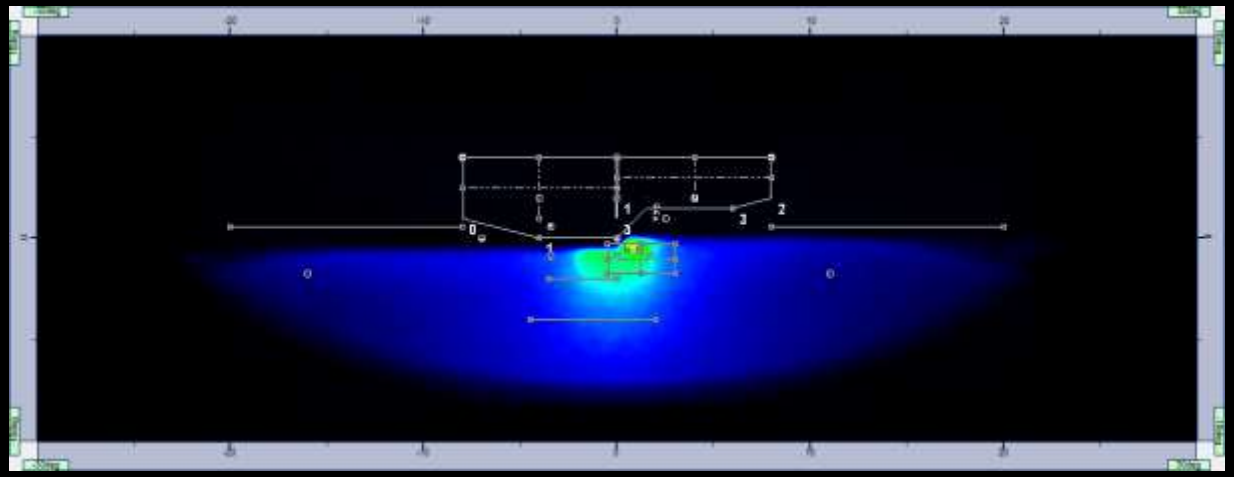
Simulated results with Ansys SPEOS Light Expert

Headlamps and Tail Lights

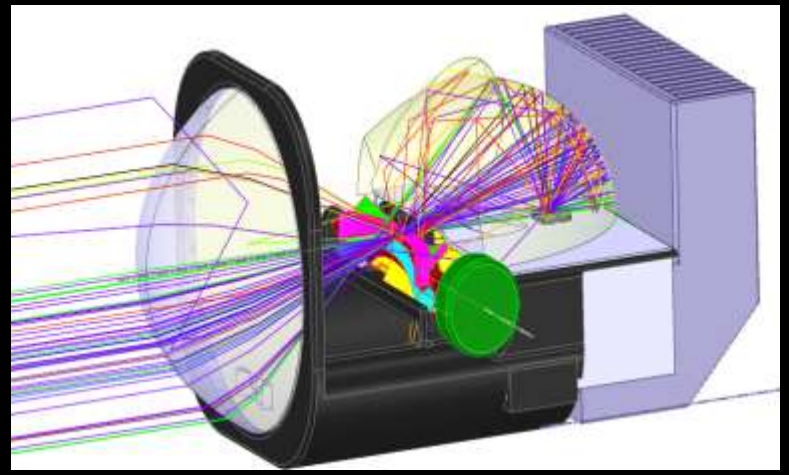
- Clean light cut-off line, minimal residual reflection
- Headlight glare reduction
- Precise Adaptive Driving Beam
- High definition road projection
- Meeting standards and regulatory requirements
- Innovative designs and unique visual effects possible

2020 Koenigsegg Jesko Absolute with Vantablack Headlights

ECE R123 AFS LB C Regulation Light Intensity Template



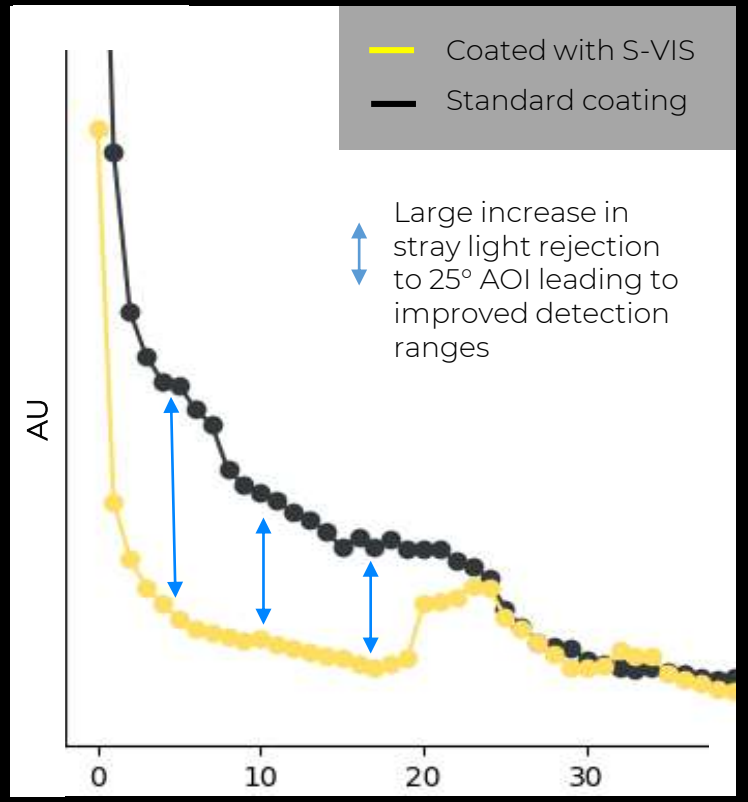
Vantablack S-VIS brings the non conforming beam pattern back to EU legal limits without a major redesign of the beam optics



Ansys beam path simulation confirming expected performance benefit

LiDAR

- Improved straylight suppression over a wide field of view with the Vantablack coated detector housing
- This results in improved LiDAR performance under difficult, high contrast daylight and night driving conditions
- Higher S/N ratio leads to increased detection range and better recognition of low reflective objects



Data courtesy Blickfeld GmbH

Conclusion

- Vantablack® coatings improve driver safety by resolving stray light issues in automotive electro-optical sensors and systems
- Are scalable and well-suited to commonly-used automotive substrates
- They exceed thermal and mechanical requirements in-service
- They do not generate fogging residues
- They are not prone to UV degradation
- Performance demonstrated in real applications
- All coatings are ROHS and Halogen compliant

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To discuss your application in more detail or for more specific technical information please contact:

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