SCHOTT

# Optical protective windows for defense

# High-performance solutions for advanced defense optronics

## Product information

SCHOTT offers integrated optomechanical sub-assemblies, including framed and coated optical windows tailored for demanding defense and harsh environments. Each window is crafted from a polished, reinforced optical substrate, which is processed to meet specific application requirements.

## Our capabilities include:

- Precision polishing and shaping of optical substrates
- Advanced coatings, such as anti-reflective and scratch-resistant layers
- Custom framing and sealing for mechanical integration
- Pressure and performance testing in accordance with military standards

These components are designed for seamless integration into defense systems and are tested to ensure maximum reliability and durability.

## Typical use cases:

- Periscopes
- Optical/targeting systems
- Electro-optical sensors (UV-IR)
- Missile warning systems
- Laser emitters and rangefinders
- Missile seeker heads (Dome)
- Surveillance cameras across VIS to LWIR

SCHOTT's expertise in materials and precision optics makes us a trusted partner for high-performance defense solutions.

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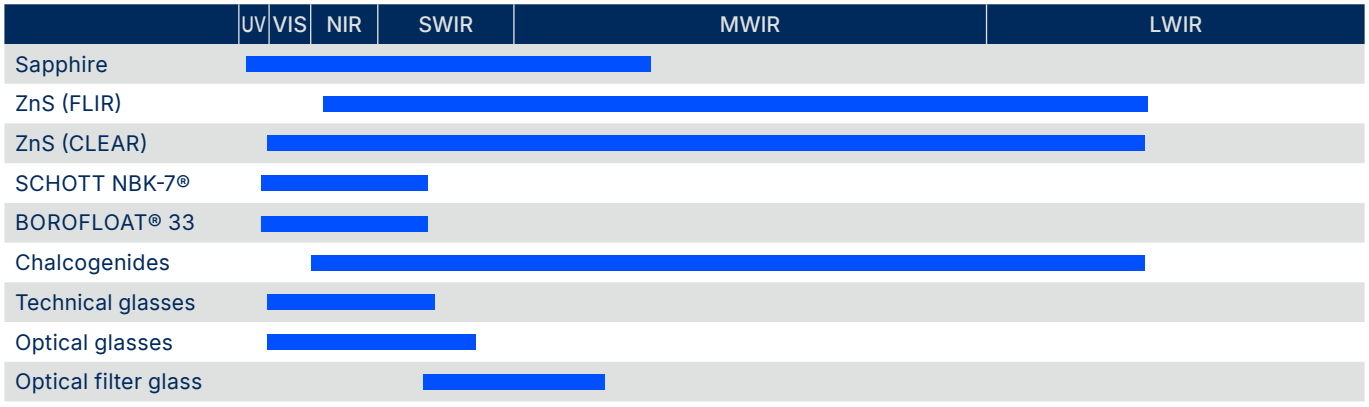
## Wide range of substrate materials




Wavelength ranges: UV → 100 nm – 400 nm | VIS → 400 nm – 700 nm | NIR → 700 nm – 1400 nm | SWIR → 1.4 µm – 3 µm | MWIR → 3 µm – 8 µm | LWIR → 8 µm – 15 µm

## Typical forms of supply*

| | |
|---|---|
| Size<br>(round and rectangular) | Ø 10 to 600 mm<br>☐ Diagonale 10 to 600 mm |
| Size tolerance | 0.05 mm |
| Thickness | 3 mm–30 mm |
| Thickness tolerance | 0.05 mm |
| Parallelism | 30 arc sec |
| Transmitted wavefront distortion (TWD) | λ/10** |
| Surface quality (scratch dig) | According to MIL 20–10 |
| Surface roughness | < 1 nm |

* Actual values depend on detailed complete specifications/tighter tolerances upon request.
** Depending on size

We offer customized processing, polishing and coating solutions. From prototyping to serial production.

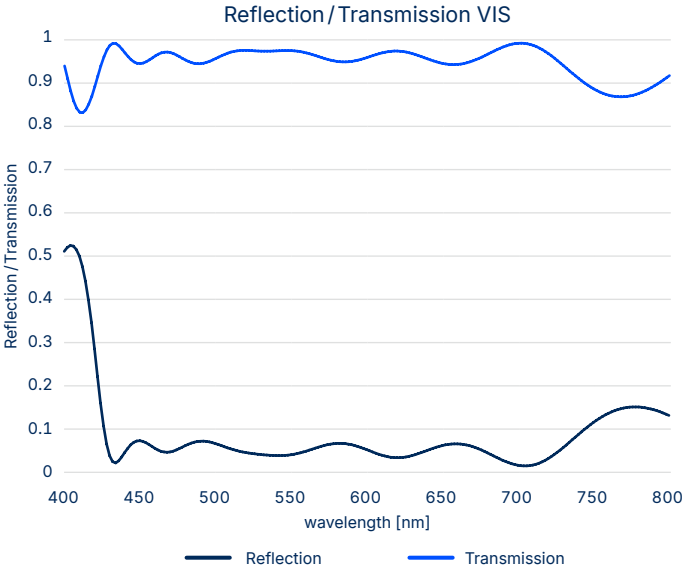
# Coatings

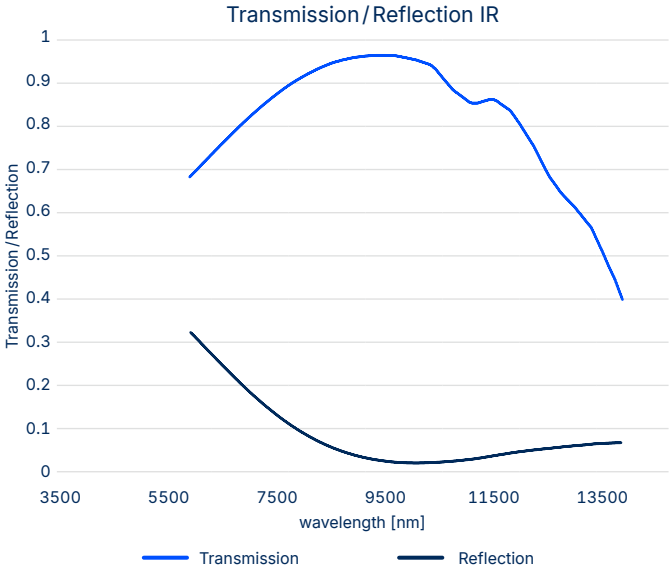
Scratch resistance is a critical parameter for ensuring the long-term performance of optical devices, whether they are integrated into hand-held devices, fixed installations, or vehicle-mounted systems. There are good coating solutions for VIS or IR available. In order to match today's requirements with respect to scratch resistance and spectral performance in the VIS and IR range a real advantage is necessary. SCHOTT combines the knowledge of high-end polishing processes together with a unique coating technology to generate customer solutions for special applications.

As an example of our exceptional coating performance, please find below the results for ZnS (multispectral), B270, SCHOTT NBK-7® and Sapphire.

## ZnS multispectral

This coating was specially designed to give low reflectance, low absorption, high transmittance in the visible 0.45 µm to 0.80 µm and IR 8–12 µm and outstanding scratch resistant performance. The coating contains no radioactive materials.



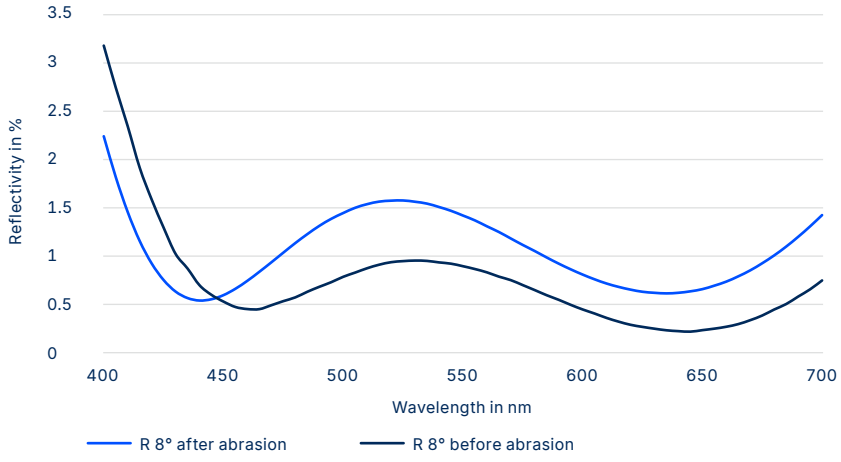
Environmental performance:

Our high end anti-reflective coatings withstand the following environmental tests – performed on a witness sample piece coated in the same batch:

| Test | Standard | Para./Method |
|---|---|---|
| Abrasion resistance | ISO 9211-4 | 01-04 |
| Windshield wiper test | TS 1888 | Para. 5.4.3 |
| Dust | **MIL-STD 810F | Method 510.5 |
| Sand | *MIL-STD 810F | Method 510.5 |
| Salt fog | MIL-STD 810F | Method 509.4 |
| Humidity | MIL-C-48497<br>MIL-C-48497 | Para. 4.5.3.2<br>Para. 4.5.8 |

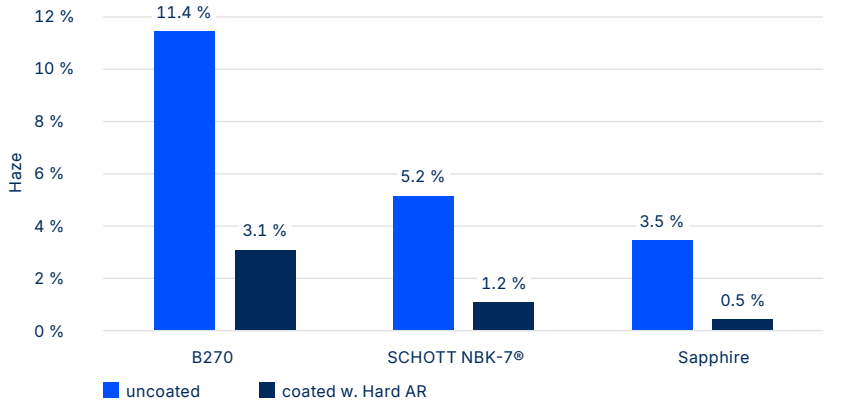
* Level of resistance depending on wavelength range and substrate material – example: for VIS-LWIR coating on CLEAR grade ZnS, in order to specify the MIL-STD 810F, evaluation was based on haze measurement, with a limit of 30 % (limit between transmissive/diffusive element), acc. to ASTM_D1003-00
** 5'000 cycles at 100 rpm / Sand : DEF-STAN 07-55
Other tests on request

B270, SCHOTT NBK-7® and Sapphire




State-of-the-art coating technologies such as e-beam, IAD; MS and IBS and Extensive know-how allow various optical coatings, including scratch resistant „hard" anti-reflective coatings, beam-splitters, ITO, electro magnetic shielding to ensure that the substrate withstands even the hardest operating conditions.

Haze measurement after "severe" Bayer test




## Modified ("severe") Bayer test

Modifications with respect to the original test:

- Harder sand: fused alumina, Mohs hardness 9
- Higher load: 2 kg (resulting in 18 mm sand layer)
- More cycles: 8000 (150 / minute)

Our metrology equipment encompasses a diverse range of high-precision instruments designed to measure and analyze various physical and optical properties of materials and components. These instruments include coordinate measuring machines, interferometers, spectrophotometers, and advanced 3D form metrology tools, among others. They are utilized for tasks such as dimensional measurement, surface roughness analysis, spectral analysis, and defect detection, ensuring the highest standards of quality and precision in manufacturing processes.

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