THz AR Coatings

As it is known THz transmittance of crystalline materials is not high (transmittance of HRFZ-Si is only ~54% and of THz-grade crystal quartz is ~70%) due to high reflection losses. However, reflection losses can be reduced by THz AR coating. We offer polyethylene and parylene coatings.

We have developed polyethylene coating technology for plane surface. Polyethylene coatings are applied for windows only. The coated windows are mounted for easy handling.

Parylene coating technology for plane surfaces is well known in microelectronics. We have improved it to achieve coating on optical surfaces (plane as well as spherical ones). So parylene coatings are used for windows as well as for lenses.

AR coating wavelength range is specified by customer. It's possible to make AR coatings for ranges within the wide interval from 60 μm to 1300 μm.
The followingAR coatings are offered:

1. Two-sided AR coating. It is used for windows and meniscus lenses. Currently AR coatings centered at the following ranges are developed:

- polyethylene coatings - 60-80 μm, 110-160 μm, 160-220 μm, 320-430 μm, 375-510 μm, 480-650 μm, 535-725 μm, 645-870, μm, 695-940 μm, and 965-1305 μm
- parylene coating 99-125 μm.

HRFZ-Si can be coated by polyethylene as well as by parylene while crystal quartz - by parylene only. Due to AR coating transmittance is ≥ 90% within any range mentioned above.

Examples of transmission curves of polyethylene coated and uncoated HRFZ-Si windows as well as parylene coated and uncoated crystal quartz windows are shown below.

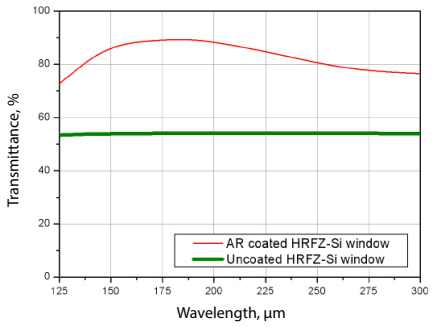


Fig. 1. Transmission of uncoated and two-sided polyethylene coated HRFZ-Si windows. AR coating is centered at 160-220 μm.

2. One-sided AR coating. Usually it is applied for hemispherical lenses. Plane lens surface is not coated since the lens is used as photoconductive antenna in THz TDS setup or in superconductive bolometer. Currently AR coating centered at the range of 99 μm to 125 μm is developed for some specific applications. AR coating increases transmittance of the hemispherical lens by 30 %. Since it's enough difficult to transmission of hemispherical lens due to its shape we have simulated transmission curves of AR coated and uncoated lenses (please see them below).

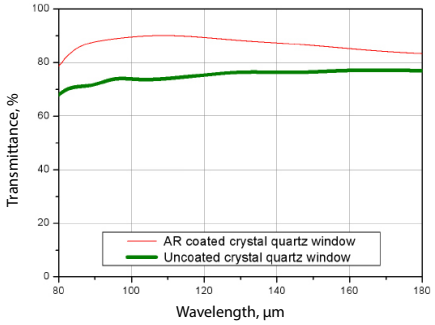


Fig. 2. Transmission of uncoated and two-sided parylene coated crystal quartz windows. AR coating is centered at 99-125 μm.

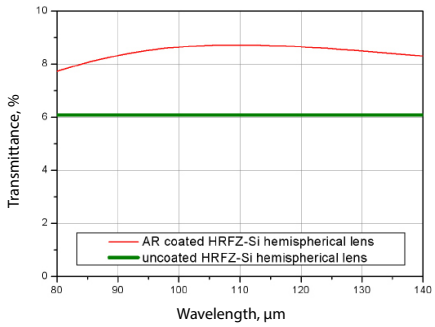
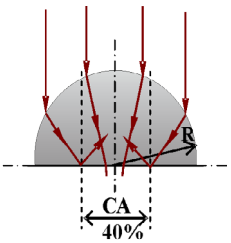


Fig. 3. Simulated transmission of uncoated and one-sided (spherical surface) parylene coated hemispherical lenses. AR coating is centered at 99-125 μm.

Experimental results achieved by one of our customers confirmed increasing of transmission due to AR coating. The gain in power in his instruments while using oneside coated hyper-hemispherical lens was about 30-50% at 111 μm.

As you see transmittance of uncoated HRFZ-Si hemispherical lens is 6 % only. It is connected with the effect of total internal reflection. The angle of total internal reflection is about 17 deg.



Due to high refractive index of silicon and lens geometry major part of penetrated into the lens THz radiation is reflected from plane lens surface-air interface. Therefore clear aperture of the hemispherical lens is 40% only. Polyethylene AR coatings as well as parylene ones centered at wavelength ranges differing from mentioned above are in progress.

Taking into account specificity of wavelength range that customer needs we manufacture AR coated windows and lenses upon request and, as a rule, they aren't available from stock. For price quotation and delivery please fax or e-mail us.

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